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ABSTRACT

The report describes an effort to develop and test instructional materials, techniques and procedures - ESSETS (environmental sensing, selection, evaluation and training system) - for teaching functionally blind young adults to use electronic travel aids (ETAs). Considered are development of training guidelines, field site selection and instructor training, field tryouts with 16 students, and findings regarding the effects of ETAs on performance. Case studies of two persons are presented to demonstrate different responses to training with the Laser Cane. Among conclusions formed were that the ESSETS materials were workable in the field and that students who participated in the study seemed to find the experience satisfying and were able to accomplish many more tasks successfully with their ETAs than without them. (CL)

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THE POTENTIAL OF ENVIRONMENTAL SENSORS FOR IMPROVING THE PERFORMANCE OF MAINSTREAMED BLIND STUDENTS

Grant No. G007604405

FINAL REPORT

Robert A. Weisgerber
Carla deHaas

Submitted to

Bureau of Education for the Handicapped
U.S. Office of Education
Washington, D.C.

October 1978

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ABSTRACT

This study grew out of a belief that blind persons could be taught how to function more effectively in their environments through the use of assistive devices, namely, electronic travel aids (ETAs). It was further predicated on the assumption that individual differences are such that alternative devices should be available at a given training site and that person/machine matching is an appropriate, productive procedure.

During the course of the study, a set of prototype materials was developed, tried out on a pilot basis in three states, and subsequently revised. These materials are referred to as the ESSETS approach, which stands for Environmental Sensing, Selection, Evaluation and Training System. The ESSETS design is such that it lends itself to use in a wide variety of locations and requires a minimal amount of instructor preparation and scoring time. It also lends itself to the accumulation and aggregation of data from various training locations, thus offering a long-term prospect for meaningful analytic research based on sufficient numbers of cases and standard procedures.

The workability of the ESSETS materials was demonstrated with trainees of a diverse nature, with different instructors, and in different sites. Various gains in performance were shown for the students involved in the study, and for the most part these gains were appreciable, suggesting that ETA training did enhance the students' environmental sensing skills.

Nevertheless, many more completed cases using the ESSETS approach are needed before definitive statements about the various ETAs can be made with confidence. Consequently, findings in the study that relate to the various ETAs are offered as preliminary conclusions and should be interpreted with caution.

The limited evidence suggests that ETA trainees at ESSETS sites markedly improved in their overall efficiency with fewer contact errors, more rapid accomplishment of tasks, and more environmental awareness. Improvement was shown on 121 of 152 attempted items of these three types. Similarly, on items that were dichotomous (the task either being accomplished

or not) the trainees were able to accomplish 39% of their 408 attempts at the time of the pretest and 95% of 402 attempts at the time of the posttest.

It is recommended that ESSETS materials be offered for more widespread use and that, in the long term, technical assistance be provided so that ETA implementation is facilitated and so that information can be gathered, meaningfully aggregated and analyzed, and shared by those who are concerned with ETA training, whether they are trainers, researchers, or developers of ETA devices.

ACKNOWLEDGMENTS

This project was the result of shared opinions and helpful suggestions from a number of persons who are actively engaged in providing services to the blind. Since the project was an outgrowth of an earlier study, many more persons were helpful than can be listed here. Nevertheless, I would like to acknowledge with thanks the work of the instructors at the field-test sites who were instrumental in the carrying out of the study design. They were: Eddie Robinson, Carol Seidberg, Bob Scheffel, Sam Hines, and Joey Baumbach.

Ms. Carla deHaas, of the AIR staff, was instrumental in developing the materials that were used in the study as well as in their revision. The preparation of this report as well as the materials was a joint effort of Carrie Davis, Anatta Blackmarr, Barbara Milligan, and Ed Carr. Their dedication to the task was very much appreciated.

Finally, the support and interest shown by Dr. Allen Dittmann and Dr. Max Mueller, of the Bureau of Education for the Handicapped, was an inspiration at a number of points in the study.

R.A.W.

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INTRODUCTION

Nature of the Problem

Orientation and mobility training (O&M) for the blind is still a relatively young field, having come into being only three decades ago as a result of the need to provide rehabilitative assistance to blinded World War II veterans. Recently, important progress has been made toward structuring this new field, as exemplified by the development of highly structured training procedures at Veterans Administration hospitals and at state and local rehabilitation agencies. Public education has recognized the importance of O&M training for blind youths, and specialists are now employed in many school districts. Accordingly, professional preparation of orientation and mobility specialists and other special educators is now being carried out at the graduate level in several universities.

The advent of orientation and mobility training programs and curricula for the preparation of specialists has been matched by increasing sophistication in the technology of aids and devices. Marked advances have been made in optical and electronics engineering, yielding devices of increasing versatility, reliability, and portability. Further, recently-developed devices are more cosmetically acceptable and less noticeable than their predecessors. There is every likelihood that engineering advances will continue to be made in the areas of miniaturization, sensitivity, and fidelity of representation of the environment. It is probable that breakthroughs in technological methods of sensing and displaying information will occur more and more frequently, as will better fitting of the devices to the individual blind person.

As this occurs, vital but rudimentary human performance skills such as detection will be increasingly complemented or supplanted by higher level perceptual skills, such as interpreting symbolic or iconographic information in the environment. Logically, one would expect that consumer interest will grow, with more blind persons expressing interest in the potential of electronic devices and requesting more assistance in their purchase. In turn, this suggests that there will be an increasing need

to set clear criteria by which qualified trainees can be identified, equipment supplied, and instructional support provided to enable blind persons to expand their vocational choices and engage in other types of activities that were not previously viable for them.

As exciting as these current and future developments promise to be, the products of sophisticated technological engineering represent a costly investment of time and energy that can be justified only to the extent that they substantially contribute to the independence of individual blind persons. Thus, a basic requirement leading to improved equipment design or more efficient training is a basic understanding of the human variables involved and how they may be assessed. Some of the pertinent questions are:

(1) What are the processes by which human beings, especially those with sensory impairment or total loss of a sensory channel, perceive and structure their environment?

(2) What are the critical elements and relationships which define an environmental situation and an individual's ability to purposefully interact with it?

(3) What modes of environmental display offer the most potential for helping an individual to develop his or her capabilities?

(4) How can alternative aids and devices be matched to individual needs and individual differences?

(5) How can training be made systematic yet flexible enough to accommodate both local circumstances and individual differences?

(6) How can evaluation be designed to provide meaningful information to the individual about his or her strengths and weaknesses in sensing the environment before and after training?

(7) How can evaluation be designed to facilitate the development of standards for teaching environmental sensing techniques?

(8) How can evaluative data be accumulated and made centrally available for research purposes?

Clearly, any approach to answering the above questions would have to be comprehensive if it is to be worthwhile. The approach should also provide for accumulation of evidence over time in order that decisions and conclusions can be arrived at in a rational way. Present practices in the O&M field are so varied from place to place, so dependent on instructor training assessment values and equipment preferences, and so limited by the few numbers of trainees at any given location that it is virtually impossible to generalize findings meaningfully across training sites. The project described in this report, while itself limited in several ways,* attempts to address these complicating factors and suggests a straightforward, easily implemented approach that can begin to answer some of these important questions.

Background of This Study

In an earlier project, carried out with support from the Veterans Administration, the American Institutes for Research (AIR) began to gather information thought to be useful in conceptualizing and organizing a systematic approach to orientation and mobility assessment, one which could be implemented uniformly at various Veterans Administration Blind Rehabilitation Centers where training with electronic travel aids (ETAs) was occurring.

This information-gathering involved (a) advice from a consulting panel composed of orientation and mobility specialists (at federal, state, and local levels), blind persons, and researchers; (b) a search

*The primary focus of the project was on persons whose visual impairment is such that they do not have useful travel vision. Also, the project was primarily concerned with environmental sensing skills enhanced by electronic devices rather than by other means.

of the literature; (c) interviews with blind and partially sighted persons, including persons who have received advanced training with electronic travel aids as well as others who have not received such training; and (d) direct observation of orientation and mobility training. Using this information, preliminary versions of materials for O&M assessment were developed. These materials included three documents, entitled:

> Environmental Sensing Skills and Behaviors: A Reference Compendium
>
> Preparatory Skills and Behaviors for Orientation and Mobility Training: A Preliminary Inventory
>
> Mastery Skills and Behaviors for Orientation and Mobility Training: A Preliminary Performance Test

Unfortunately, changes in Veterans Administration funding patterns for external research effectively precluded the field testing and refinement of those materials, although certain key VA staff who were involved in that project may yet do so.

The present study, sponsored by the Bureau of Education for the Handicapped, U.S. Office of Education, builds upon that earlier work and has carried it to a considerably greater degree of comprehensiveness and refinement. Even more so than in the VA (where uniform procedures can be achieved administratively, the cause of blindness is typically adventitious rather than congenital, and costs for equipment are not such a critical factor) the secondary and postsecondary levels of education can benefit from assessment and training materials that (a) place a priority on the needs of individual blind students--now mandated by P.L. 94-142, (b) facilitate judgments about whether electronic travel aids could benefit the blind individual, and (c) can be implemented easily and consistently.

Although it may only have been implied above, it should be clearly understood that this project is a pioneering one with no similar materials or approach known to us. In a sense, it can be thought of as a transitional study; for as thorough and polished as its products may appear it should be kept in mind that, by design, it is hoped that new information can be

gathered from implementing schools that will lead to future refinements and to the development of complementary materials designed for other subsets of the blind population, such as those who have low vision and can use other types of aids.

Purposes of the Study

The proposal for the study listed four project objectives:

- To develop prototype instructional materials, techniques and procedures appropriate for teaching environmental sensing to functionally blind young adults, and which build upon evaluation protocols previously developed by AIR.

- To train selected teachers in the proper use of the instructional materials in order to elicit maximum development of the blind individual's potential for environmental sensing in relation to his/her needs.

- To plan and cooperatively carry out tryouts of these prototype materials at selected educational institutions, with subsequent revisions as appropriate.

- To evaluate the educational potential of alternative environmental sensing devices in terms of the progress made by each blind participant toward a more independent level of mobility in school and college settings and in the community at large.

While not listed, an implicit additional objective involved the preparation of the final project products in sufficient quantity so that schools and colleges across the country can obtain sets if and when they decide to implement the approach.

Beyond these project-centered objectives, of course, it was the hope of the AIR staff that the materials would have long term benefits to blind

persons who seek to develop or improve their environmental sensing skills and to direct or indirect service providers, whether they are instructors, engineers, or researchers.

Potential Benefits

The results of this research study should be of direct and principal benefit to the following groups:

- Blind young adults engaged in study at the secondary and postsecondary levels will have new options open for increasing their functional independence. For example, blind junior college students should more freely engage in travel on and off campus, with the latter quite possibly affecting their job opportunities and employability upon graduation.

- Mobility instructors and special educators in the public schools will be materially assisted in the assessment of blind students' performance, in increasing their own familiarity with new environmental sensing devices, and in the application of specialized teaching methods that are essential for proper use of these devices.

- To the extent that it is implemented on a sustained basis, researchers and engineering personnel should find in the environmental sensing compendium and evaluation protocol a valuable tool for collecting and aggregating data on trainee performance and man-machine interface problems as new devices enter the marketplace.

What is envisioned is a plan for long term sharing of information (see diagram on the following page). Realistically, the plan could only be initiated in the present study and requires additional funding to be fully carried out.

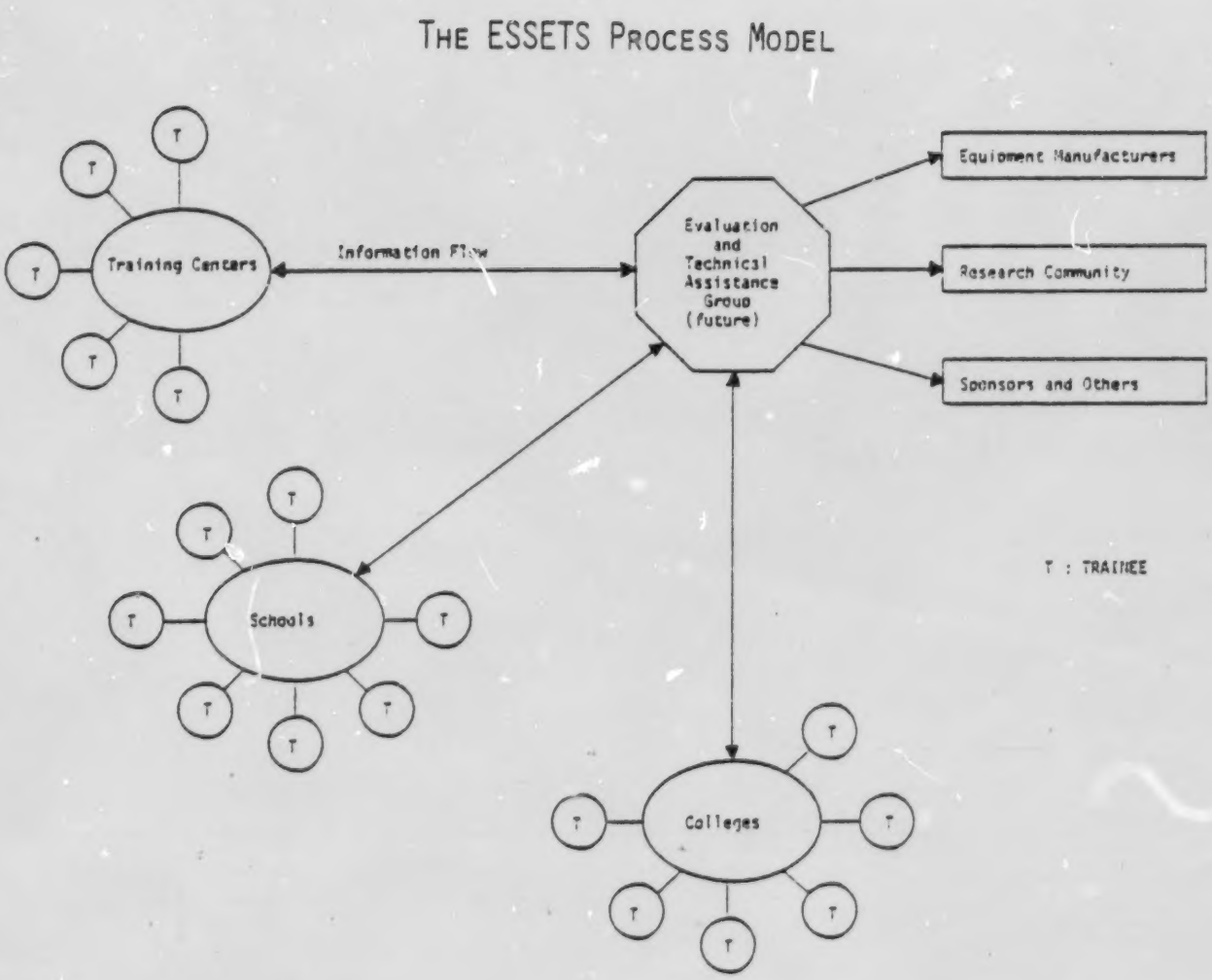

Figure 1. A plan for long term sharing of information.

PROCEDURES

Conceptualization and Development of ESSETS Materials

At the outset of the project, staff reviewed the preliminary materials (that had been developed under VA contract) in the light of critiques that had been accumulated from some 15 field sources with whom these initial materials had been shared. This analysis was carried out as a transition from the old study to the new. It was evident that while the earlier framework was seen as useful there were a number of ways in which these materials could be improved in the current project. Mainly, these centered on shortening the overall amount of material, adding specific items on ETA usage, and including factors other than performance data (such as health factors, cost factors, etc.) in the selection/matching process. Project staff also updated their file of O&M references in the literature that were thought to be helpful in the conceptualization of how the new materials should be designed.

Following these review and updating steps, project staff planned the structure of the approach that would be used in the current study. As will be made clear in subsequent discussions, the new approach that was developed and tried out in the field in the present study also went through a revision process. Table 1 shows the relationship between the prototype products developed in Year 1 of the study, and the final versions as produced in Year 2, following field tryout and revision. The field tryout results and case studies, as reported in the Results section, pertain to the prototype materials. The reader should note that whenever the acronym ESSETS is encountered in this report, reference is being made to the final version of the materials. ESSETS stands for Environmental Sensing, Selection, Evaluation and Training System and encompasses all the final documents that are interrelated in this systematic approach.

TABLE 1

Comparison of Materials as Initially Developed in Year 1 and as Finally Produced in Year 2

Prototype Materials Developed in Year 1	Final Materials Developed in Year 2
ENVIRONMENTAL SENSING REFERENCE COMPENDIUM	ENVIRONMENTAL SENSING REFERENCE COMPENDIUM (with minor corrections)
ENVIRONMENTAL SENSING EVALUATION PROTOCOL	ENVIRONMENTAL SENSING SELECTION AND MATCHING
Section A - Matching Procedures	Part A. Selection of Candidates
Section B - Evaluative Considerations	Part B. Matching with Electronic Aids
Section C - Readiness Trials	ENVIRONMENTAL SENSING EVALUATION OF ATTAINED PERFORMANCE
Section D - Performance Trials	• General Information
Section E - Mastery Tests	• Level 1 - Structured Settings/ Controlled Travel
ENVIRONMENTAL SENSING TRAINING GUIDELINES	• Level 2 - Semi-Structured Settings/Intermediate Travel
Section I - Introduction to Training	• Level 3 - Unstructured Settings/ Independent Travel
Section II - Orientation to ETAs	• Interview
Section III - Assessing Trainee Needs and Development	• Overall Performance Evaluation
Section IV - Assessment Forms	ENVIRONMENTAL SENSING TRAINING GUIDELINES
	• General Information
	• Instructor Preparation
	• Individual Assessment for Course Design
	• ESSETS Training
	• Assessing Outcomes

Reference Compendium

As indicated previously, the Reference Compendium is intended to serve as a conceptual base from which one can work, whether developing assessment materials or training materials. During the process of revision, in the first year of the project, substantial changes were made in the structure of the compendium. Principally, these were made to reduce redundancy across sections, to make specific entries easier to locate, and to modify the wording of examples and entries to clarify meanings.

It should be noted that the compendium is not an orientation and mobility training manual. However, it may lead to the rethinking of some training procedures and may suggest areas in which training may be needed. Similarly, the compendium has not been restricted to mobility functioning per se. It is recognized that blind persons may utilize newly learned environmental sensing skills for personal and vocational applications other than those involving travel toward a destination. The compendium offers no judgments about the relative importance of various environmental sensing skills. While such priorities may exist, it is likely that they would be influenced a great deal by individual differences among trainees and by design limitations of any sensory aids which they are taught to use.

In its revised form, the compendium categorized environmental sensing under the following eight topical headings:

- Relating Body-Image and Surrouding Space

  covers the formation of fundamental physical self-awareness and the basic application of such awareness in order to develop a concept of one's relationship to surrounding space.

- Perceiving and Defining the Environment

  is concerned with the basic functioning of the physical senses to enable perception, and the subsequent interpretation and identification of environmental elements, events, and contexts.

- Relating Personal Movement to Environmental Factors

  deals with adjustment of intentional lines of travel and other movement skills in reponse to perceived environmental elements, and a functional knowledge of compass directions.

- Relating Personal Movement to Distance, Time, and Rate

  outlines methods of relating and estimating distance, time, and rate, as well as factors influencing such estimations.

- Compiling a Cognitive Map

  presents the processes involved in developing cognitive maps of both the locale-specific type and the generic type, with emphasis on organizing environmental information, concept formation, and the use of compass directions.

- Planning, Executing, and Assessing Travel Routes

  enumerates steps leading up to, and involved in, executing travel routes, and includes sections on the use of public transportation, the solicitation of aid, and the correction of travel errors.

- Optimizing Travel Performance

  presents skill and behavior areas to be addressed by those seeking to perfect their travel performance, and criteria for improvements and refinements which could enhance the performance of even those who are already accomplished travelers. It includes a section on sensory aids, and a section on evaluating travel aids for improving the performance of the individual.

- Analyzing Personal Attributes for Greater Independence

  reviews personal development factors which can enhance independent functioning and thus contribute to a more full and satisfying life.

Each topical area is delineated by a brief working definition. This is followed by a stated rationale--an explanation of the relationship of the topical area to individual human performance. Examples of effective and ineffective behaviors are then provided in order to illustrate more clearly the practical impact of specific skills in a given topical area. Finally, those factors which are thought to be components of the topical area are presented in outline form. When the sequence of contributing factors is thought to have a priori relevance, this sequence is reflected in the order of their presentation. A glossary has been included to facilitate understanding of the terms used. An index enables the user to locate discrete concepts, skills, or behaviors in the body of the work. Excerpts from the revised compendium are shown in Appendix A.

Selection and Matching

One of the main concerns of this project is to offer a rational and thoughtful procedure for deciding whether a candidate for training with ETAs appears likely to benefit from such training and therefore should undertake it. Similarly, the project sought to establish fair and reasonable procedures by which trainees and devices could be "matched" to best advantage. There is, of course, no guarantee that the individual will master the ETA and become fully independent. Rather, the premise of the selection and matching process is that the odds for successful training and eventual maximum utilization of the ETA will be increased because of the systematic procedures involved.

The contents of the revised Selection and Matching module are outlined below. Process diagrams and excerpts from the final materials are included in Appendix B.

GENERAL INFORMATION
- Environmental Sensing and Electronic Travel Aids
- Purpose and Potential of the ESSETS Approach
- An Overview of ESSETS Components and Activities
- Glossary of Terms and Abbreviations
- Trainee Profile Sheet

PART A, SELECTION OF CANDIDATES
- Physical/Medical Factors
- Internal Motivation
- External Influences
- Cost Considerations
- Readiness Assessment
  - Emphasis on basic mobility skills
  - Emphasis on awareness of environmental elements
  - Emphasis on functional knowledge of compass directions
- Overall Selection Score Sheet
- Profile for Selection of Candidates

PART B, MATCHING WITH ELECTRONIC TRAVEL AIDS
- Matching Trials for the Pathsounder
- Matching Trials for the Mowat Sensor
- Matching Trials for the Nottingham Obstacle Detector
- Matching Trials for the Laser Cane
- Matching Trials for the Sonic Guide
- Overall Matching Score Sheet
- Profile for Matching with Electronic Travel Aids

In Table 1, on page 9, it can be seen that Sections A through D of the Evaluation Protocol in the prototype materials (the materials tested at

the sites) corresponds roughly to the above final version. Data in the Results section are based on these earlier prototype materials.

Four devices were originally included in the prototype materials: the Pathsounder, the Nottingham Obstacle Detector, the Laser Cane, and the Sonicguide. Another device became commercially available in the first year of the study, the Mowat Sensor. It was decided that a subset of materials should be developed for this device and "folded in" since several of the sites expressed interest in it. (This had the effect of testing our assumption that the materials could be added to when new devices came into the market place without destroying the integrity and usefulness of the materials. This proved to be a correct assumption.)

Evaluation of Attained Performance

The contents of this portion of the ESSETS final materials are derived largely from Section E (Mastery Tests) in the prototype materials as used at the field test sites and reported on in the Results section of this report. Generally, the materials worked well and few problems were encountered. In the main, revisions were undertaken with a view to shortening the amount of test time required (several exercises were dropped, several were combined, one was radically altered, and one other was newly created). A structural realignment of the exercises enabled the categorization of exercises into three levels, with the subsequent result that the Evaluation of Attained Performance module could be used for interim or progress assessment as well as for assessing overall outcomes.

In the final ESSETS version, Level 1 contains six exercises and relates to demonstrated performance in structured settings where travel is essentially controlled. Level 2 contains seven exercises and relates to demonstrated performance in semi-structured settings where travel reaches an intermediate level of complexity. Level 3 contains eight exercises and relates to demonstrated performance in unstructured settings where travel is essentially independent and complex in nature. Appendix C shows an example of the revised format recommended for the assessment of trainee performance before and after training.

Training Guidelines

The prototype Training Guidelines supplied to the field test sites were quite comprehensive, and it appears contained more information than was likely to be acted upon. Specific examples of lesson planning and "homework" planning were given for each of the ETAs at each level of training. Instructor time, it would appear, is at such a premium that this complete pre-planning is not likely to occur even when illustrative models are provided. Accordingly, this and other portions of the Training Guidelines were substantially shortened from the earlier prototype version.

Another basis for revision stemmed from the new strategy for evaluation by levels of attainment. This had clear ramifications for training since the approach to training for Level 2 should certainly take into account the performance results for the preceding Level 1.

It should be pointed out that the Training Guidelines also provide for instructor preparation. In the course of the present study this was accomplished through on-site workshops conducted by AIR staff.

Field Site Selection and Instructor Training

Selection of Sites

Sites for tryout of the prototype materials were selected with several considerations in mind. First, the site had to have on its regular staff a qualified instructor in electronic travel aids, i.e., a person who had been certified by one of the universities or colleges offering graduate ETA training, over and above that training which leads to regular orientation and mobility certification.

Second, we looked for locations that were away from the geographic points where ETA training is concentrated at the college level and where most of the qualified teachers were concentrated (Northeast, North Central, Northwest). We hoped that by making this type of selection the prototype centers might continue their use of the ESSETS approach following the grant and thus serve a "lighthouse" function in future years.

Third, we were interested in identifying centers which served both secondary and postsecondary levels and which, presumably, had the potential to serve a number of blind students in their catchment area.

Lists of qualified instructors were developed from lists of graduates at Boston College, University of Western Michigan, and San Francisco State, and supplemented by lists of qualified instructors known to manufacturers of the two most complex devices, the Laser Cane and the Sonicguide.

Using the criteria mentioned previously, and following a preliminary site visit by the project director, we selected Atlanta, Georgia and Columbia, South Carolina as two of the sites. At a later time, occasioned by the moving of a qualified instructor, it was decided that Flagstaff, Arizona would serve as a third site. Eventually, when it became apparent that this site would not be ongoing (for reasons not related to this study) it was decided that Phoenix should participate, thus offering continuity of effort in the Southwest.

Table 2, which is a listing of site visits, identifies the participating sites, and shows the AIR staff making the visits as well as the purpose of each visit.

Instructor Training

In order to explain the use of the prototype materials and assure that the instructors at each site were familiar with each of the devices, project staff conducted short workshops for the participating instructors. Atlanta and Columbia instructors were trained at Columbia, the Flagstaff instructor was trained in Palo Alto (before she moved from the Bay Area), and the Phoenix instructor received orientation in Phoenix.

Figure 1 shows the sequence of instructional and evaluation stages as covered in the instructor workshops. Hands-on practice with materials and with the devices was an important part of this familiarization process.

Midway during the course of study, after selection and matching data were obtained for identified students in Atlanta, the ETA-qualified

TABLE 2

Listing of Site Visits

Sites Visited*	Dates	Site Visitor	Purpose of Visit
1977:			
Atlanta, GA	April 18-19	R. A. Weisgerber	Selection of project site
Columbia, SC	April 19-20	R. A. Weisgerber	Selection of project site
Columbia, SC	July 31-August 5	C. deHaas	Conduct workshops for field testing modules
1978:			
Atlanta, GA	January 17-24	C. deHaas	Data collection and on-site project assistance
Columbia, SC	January 25-30	C. deHaas	"
Phoenix, AZ	February 1	C. deHaas	Possible site selection
Flagstaff, AZ	February 2	C. deHaas	Conduct familiarization
Atlanta, GA	April 1-2	R. A. Weisgerber	Data collection and on-site project assistance
Columbia, SC	April 3-4	R. A. Weisgerber	"
Flagstaff, AZ	April 10	R. A. Weisgerber	"
Phoenix, AZ	April 11	R. A. Weisgerber	Conduct familiarization
Atlanta, GA	September 27-28	C. DeHaas	"
Columbia, SC	September 29-30	C. DeHaas	"

*The specific agencies at each site are:
South Carolina Commission for the Blind, Columbia SC
Atlanta Area Services for the Blind, Atlanta, GA
Department of Economic Security (Arizona Industries for the Blind), Phoenix, AZ
Institute for Human Development (Northern Arizona University), Flagstaff, AZ

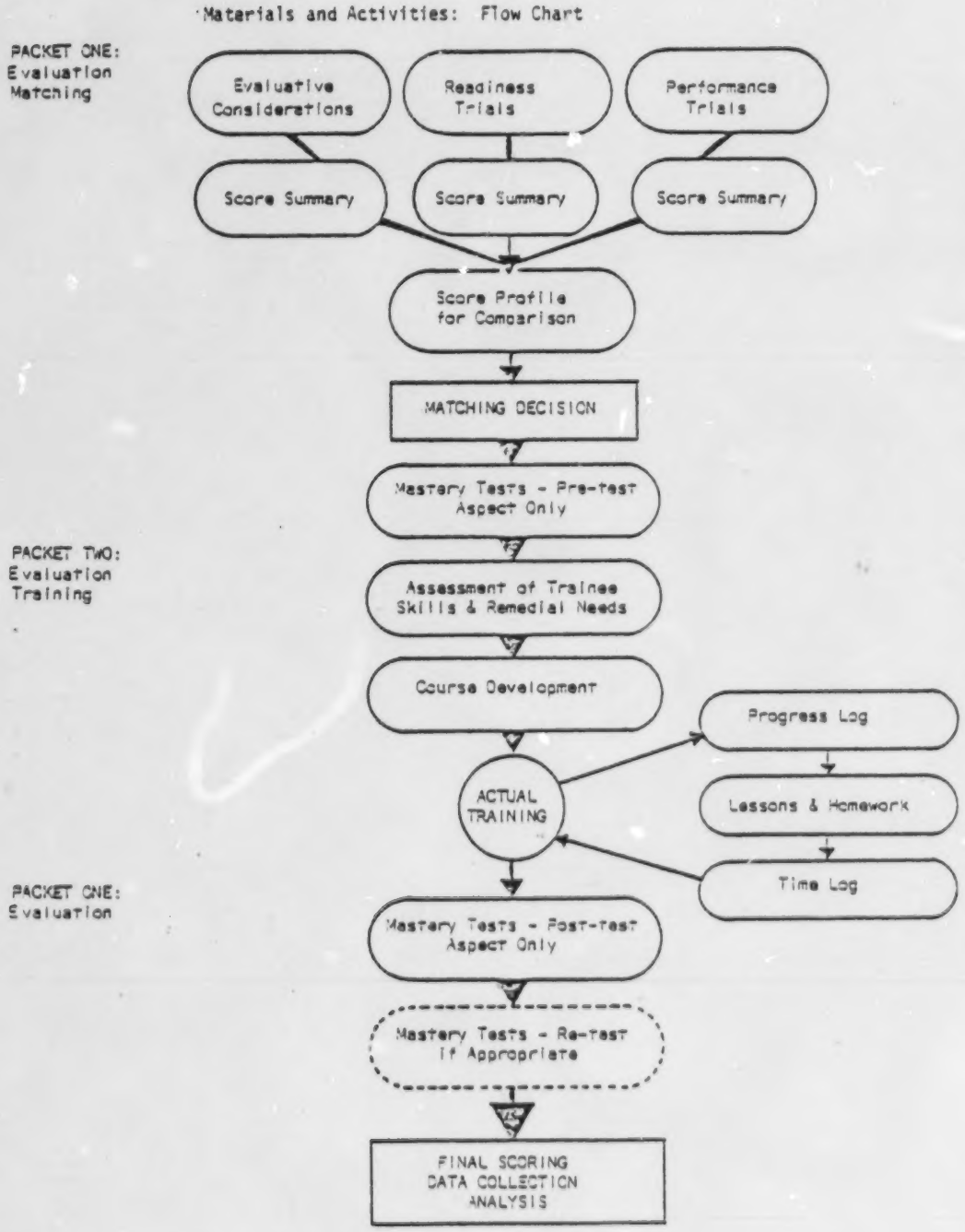

Figure 2. Sequence of instructional and evaluation stages (prototype materials).

instructor left to take a position in another state. The agency expressed its intent to send another instructor for ETA certification and to continue in the project. This was done, but had the effect of severely disrupting the timeline of training (and tryout of the materials) at that site.

Subjects and Field Tryouts

The ESSETS approach has been designed as a flexible system in that it can be implemented on a one-for-one basis locally whenever eligible students are identified and instructor time is available. Just as will occur in natural school settings, some students who were considered potential participants, including some who began the training, did not finish for a variety of reasons discussed more fully below. Similarly, differences among the cooperating centers in terms of staffing, available instruction time, etc., resulted in considerable variation in the completeness of the field tryouts across sites.

Subjects: Altogether, 16 students were considered eligible for participation across the four cooperating sites. For brevity of presentation they are listed below, along with a brief description followed by a comment explaining the subsequent status of their involvement. Case studies included in the Results section of this report will more fully describe the students on whom data were obtained, at least through the matching procedure. (The "Travel" adjectives reflect general impressions only.)

The Student	Level of Schooling	Travel Characteristics	Status of Training
L.A.	College	Rapid Traveler	Completed all materials
C.R.	College	Confident Traveler	Selection/matching completed
S.B.	College	Tentative Traveler	Selection/matching completed
J.J.	Middle School	Beginning Traveler	Completed all materials
S.M.	High School	Deliberate Traveler	Completed all materials
T.M.	High School	Erratic Traveler	Selection/matching, low potential
S.H.	Elementary School	Confident Traveler	Completed all materials
W.J.	Middle School	Deliberate Traveler*	Selection only; had major operation

*Slight amount of travel vision

The Student	Level of Schooling	Travel Characteristics	Status of Training
R.C.	College	Confident Traveler	Completed all materials
D.J.	College	Confident Traveler	Completed all materials
B.M.	Institutionalized	Minimal (retarded)	Dropped; mainstream-impractical
M.A.	College	Confident Traveler	Tried equipment; disinterested
S.J.	Primary	Minimal	Parental permission withdrawn
M.F.	High School	Confident Traveler*	Completed all materials
F.B.	College	Fair Traveler	Lacked prior O&M
M.G.	College	Confident Traveler	Training postponed until later

*Some residual travel vision

Field Tryouts: Each instructor was responsible for arranging and carrying out the testing and training schedules for their students. In most instances this translated to period-long sessions from one to three times per week. Overall training time varied considerably across devices.

Assessments were carried out in accordance with the recommended procedures in the prototype materials. When local circumstances precluded this, instructors were to note what the exceptions were in the remarks portion of the appropriate form.

Various exercises allowed instructor discretion about whether the assessment would be conducted indoors or outdoors, but stipulated the kinds of materials/equipment that would be involved and how they should be set up. Thus, one instructor carried out identical exercises in a large gym at one location and outside the school at another location because the circumstances and conditions of the exercise were best met by those variations.

Tryouts were interrupted for about six months at the Atlanta site due to the departure of the qualified ETA instructor. Though his replacement was eventually certified, this delay prevented completion of student training. It is expected that such training will continue beyond the period of this grant.

RESULTS

Selection and Matching Findings

Selection of Candidates

Before a student enters ETA training it is appropriate to establish whether the person is likely to benefit from such training. Among the factors that should be considered are the individual's

- physical/medical status--whether special limiting considerations exist
- internal motivations--whether interests, independence, and persistence are evident
- external influences--whether there are existing reasons that travel is necessary
- cost considerations--whether the purchase of a device will be possible either through personal funds or outside assistance

In addition to the above evaluative considerations, at least three types of readiness are thought to be important. They include the individual's

- skill in the use of the long cane
- understanding of elements that are typical of commonly encountered environments
- functional knowledge of compass directions.

Low scoring in one or more of the above assessments would not normally constitute a basis for excluding a person from training. Rather, it suggests an area(s) of weakness that might require remedial instruction, necessitate some compensating adaptations, or imply the need to set more modest training goals. If low scores are shown on several of the above seven measures there may be some justifiable doubt as to whether the individual should proceed with ETA matching and training, especially if other candidates appear to be better prospects. (It should be noted that this screening step is not intended to permanently exclude individuals from ETA training but rather to indicate to them that they will probably find it more difficult and less rewarding than most other ETA trainees.) Appendix B shows an excerpt of the Selection materials.

Table 3 shows the summary scoring on these seven measures for those students who completed the selection portion of the prototype materials. Those students who eventually continued into training, and were pre- and posttested, are listed above the dotted line in Table 3.

Examination of Table 3 evaluative considerations shows that all the students were "OK" from a physical/medical viewpoint, and therefore could have utilized any of the devices. Students who continued into training tended to score fairly high on internal motivation criteria but only moderately in terms of external influences that might indicate a need for an ETA. Cost considerations were generally not expected to be an insurmountable problem, though it was clear that in some instances special arrangements for financial assistance would have to be made. In one case it was expected that cost would make acquisition of a device unlikely, and that individual did not proceed through the matching activities.

Examination of the Readiness Trials portion of Table 3 shows the diversity among the candidates being considered for training. Trainees M. F. and J. J., for example, clearly differ in terms of their general level of mobility and cane techniques (Trial 1),* in awareness of environmental elements (Trial 2), and directions (Trial 3). However, J. J.'s scores are <u>not</u> low enough to recommend against training.

If one were to make judgments about their benefits from training at this point (noting that both eventually received laser cane training) it would be logical to assume that M. F. might be the better performer of the two. It is appropriate to keep in mind that the information in Table 3 is gathered prior to and separately from any matching between the individual and particular devices. The results from the matching exercises should, of course, provide additional insights.

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*In the prototype materials Trial 1 was one evaluation form consisting of 12 items. It was scored separately in terms of item importance for a given device. Thus, 11 of the 12 items had relevance in terms of Laser Cane functioning (e.g., wrist rolling), while only six had relevance to the Sonicguide (e.g., head positioning).

TABLE 3
Summary of Selection Scores for Candidates for Training

	B - EVALUATIVE CONSIDERATIONS				C - READINESS TRIALS						
					Trial 1[c]						
	Physical/ Medical[a]	Internal Motivation	External Influences	Cost Consid.[b]	SG	LC	NOD	PS	Trial 2[d]	Trial 3[e]	Final ETA Match
Maximum # of Decision Pts		11	4		6	11	5	7		12	
STUDENT:											
L.A.	OK	.82*	.75*	1	.67	.82	1.00	.86	High	1.00	Sonicguide
M.F.	OK	1.00	.75	2	1.00	1.00	1.00	1.00	High	.92	Laser Cane
D.J.	OK	1.00	.75	2	1.00	.91	1.00	.86	High	1.00	Mowat
J.J.	OK	.73	.75	1	.50	.73	.60	.57	Moderate	.75	Laser Cane
S.H.	OK	1.00	.25	1	.83	.91	.80	.86	High	.25	Sonicguide
S.M.	OK	.82	.50	1	.67	.91	.20	.71	Moderate	.75	Laser Cane
R.C.	OK	1.00	.75	2	1.00	.91	1.00	.86	High	1.00	Sonicguide
T.M.	OK	.18	.25	2	.83	.73	.80	.86	High	.50	
S.J.	OK	.73	.50	3	x	x	x	x	x	x	
M.G.	OK	1.00	1.00	1	1.00	.82	1.00	.86	Moderate	.83	
F.B.	OK	.45	.75	1	.67	.64	.80	.57	Moderate	1.00	
W.J.	OK	.54	.50	1	.83	.91	.80	.86	High	.67	
S.B.	OK	.54	.75	1	.17	.18	.00	.14	Moderate	1.00	
C.R.	OK	1.00	1.00	1	.83	.91	1.00	.86	High	1.00	

[a] OK indicates no physical/medical problems which would limit the choice of ETAs.

[b] "1" indicates cost factor is not a problem; "2" indicates cost factor might be a problem; "3" indicates a definite cost problem.

[c] General mobility skills, emphasizing long cane techniques, with scoring in terms of device/task relevance. SG = Sonicguide, LC = Laser Cane, NOD = Nottingham Obstacle Detector, PS = Pathsounder.

[d] Awareness of elements present in commonly encountered environments.

[e] Functional knowledge of compass directions.

* Expressed as a proportion of the maximum number of decision points, with higher proportions indicating a greater degree of eligibility for training.

Matching of Candidates

The assumption of these materials and the systematic procedures recommended in the ESSETS approach is that individuals should be involved in deciding what ETA is best for them. Each student was given a series of performance trials with each device* and was also interviewed about his or her reactions to it. (See Appendix A for excerpts of Matching materials.)

Table 4 summarizes the results of the Matching Performance trials and corresponding interviews for each ETA. For ease of comparison the results are shown in terms of high, moderate, low, not advisable evaluations. To arrive at these evaluative labels, item scores were tallied and summed for each device. Summary scores for primary or easier items were then weighted by a factor of two, and advanced or harder items were weighted by a factor of three. The combination of these two scores was then compared to an interpretation key to establish the qualitative rating. Interview items were summed but not weighted, then compared to a separate interpretation key to establish the qualitative rating.

Inspection of Table 4 shows that most of the individuals performed at a high level on their trials with the various devices. That is, they were generally able to use the devices to accomplish the intended tasks at acceptable levels. Some persons, however, only exhibited moderate or even low performance with a given device.

Most revealing is the variation between their performance in the trials and their reactions when interviewed. Even though a device could be used effectively it was not necessarily liked. Factors such as cosmetic appeal, feelings about the signal display, likely situations for its use, etc., clearly had an important bearing on the candidate's evaluations. Note, for example, that although seven of the persons tested scored well on Sonicguide performance trials only two of them clearly preferred it. Similar contrasts can be noted for the other devices.

*Because it was added later in the study, not all students had Mowat Sensor Performance Trials.

TABLE 4
Summary of Matching Scores of Candidates for Training

D - MATCHING PERFORMANCE TRIALS

Student	PATHSOUNDER TRIALS		NOD TRIALS		LASER CANE TRIALS		SONICGUIDE TRIALS		Final ETA Match
	Performance	Interview	Performance	Interview	Performance	Interview	Performance	Interview	
L.A.	High	Not Advisable	Low	Not Advisable	High	Moderate	High	High	Soniceuide
M.F.	High	Moderate	High	Not Advisable	High	Moderate	High	Not Advisable	Laser Cane
D.J.	High	Not Advisable	High	Moderate	High	Moderate	High	Not Advisable	Mowat *
J.J.	High	Not Advisable	High	Not Advisable	High	High	High	Not Advisable	Laser Cane
S.H.	High	Low	Moderate	Low	High	Moderate	Moderate	Moderate	Soniceuide
S.M.	High	Low	High	Moderate	High	High	High	Not Advisable	Laser Cane
R.C.	High	Not Advisable	High	Not Advisable	High	Moderate	High	High	Soniceuide
T.M.	High	Not Advisable	Moderate	Low	High	Moderate	Moderate	Not Advisable	
S.J.	x	x	x	x	x	x	x	x	
M.G.	x	x	x	x	x	x	x	x	
F.B.	x	x	x	x	x	x	x	x	
W.J.	x	x	x	x	x	x	x	x	
S.B.	High	Low	High	High	Moderate	Low	Moderate	Not Advisable	
C.R.	High	Not Advisable	High	Not Advisable	High	Moderate	High	Low	

*Trainee D.J. also went through a series of Matching Performance Trials with another ETA, the Mowat Sensor. His scores were high on performance and moderate on the interview.

Let us again compare the two cases of M. F. and J. J. The scores for these two cases are as follows:

M. F.

	Primary Trials	Advanced Trials	Interview
Pathsounder	9 of 9*	10 of 10	5 of 6
NOD	9 of 11	11 of 13	2 of 5
Laser Cane	22 of 22	15 of 17	8 of 9
Sonicguide	17 of 18	16 of 17	5 of 8

J. J.

	Primary Trials	Advanced Trials	Interview
Pathsounder	8 of 9	10 of 10	2 of 6
NOD	11 of 11	13 of 13	2 of 5
Laser Cane	20 of 22	13 of 17	9 of 9
Sonicguide	18 of 18	17 of 17	7 of 8

*Indicates achieved 9 of 9 tasks, with "yes" entered in response space.

It can be seen that M. F., who had high ratings during the selection stage, rated high in his performance on all of the ETAs, and therefore seems to be highly qualified in every respect. M. F.'s feelings about the devices, and what they could do for him, are not nearly so positive. Remembering that it was earlier pointed out in this report that M. F. was a confident traveler, with a limited amount of travel vision, his high performance scores are not unexpected. Similarly, in terms of feelings, M. F. was not "turned on" by any device that he thought might draw unwanted attention to his blindness. The decision to proceed with the Laser Cane reflected, in the main, his desire to improve his dusk and evening travel, at which times he would normally use a white long cane.

J. J., by comparison, though totally blind and classified as a beginning traveler, also did well on all the ETA performance trials but had one "high" and three "not advisables" in his interview scores. The decision for the Laser Cane was therefore straightforward and easy to make in J. J.'s case.

Electronic Travel Aid Effects on Performance

Overall Effects of ETAs

One of the fundamental questions to be answered in this study was whether the use of ETAs made any important difference in the abilities of blind individuals to sense their environment and respond to it in appropriate ways. Certainly, this is important to establish since if marked improvement were not shown then the considerable investments in training time and in the cost of equipment purchase might be negated to a large degree.

It should be kept in mind that this study was not conceived as a way of saying that one type of ETA is "better" or "worse" than any other, but rather that they have different utility for different persons, presumably optimized through the matching process. One way to answer the question, then, is to aggregate the effects of using ETAs for all those persons on whom pre- and post-scores were obtained. For this aggregation each person's performance on a criterion item is considered a discrete test of performance, irrespective of which type of device was utilized. Results are shown in Table 5 for those criterion items which consisted of dichotomous "Yes-No" performance assessments (i.e., where a specific task was or was not accomplished). As an example, criterion 21.3 was stated, "Trainee locates seated person without cane contact or body contact with person." Appendix C shows excerpts from the mastery tests of attained performance.

TABLE 5

Aggregated Performance on
Dichotomous "Yes-No" Criterion Items

	Number of Items in Materials	Number Attempted by Trainees	Number Accomplished	% Success
Pretest	497*	408	160	39.2%
Posttest	497	402	384	95.5%

*71 items actually appeared in the prototype materials. This represents the aggregate of items across all trainees.

It is clear from Table 5 that for those items the trainees attempted in both pre- and posttests there was a high degree of improvement in their success. It should be kept in mind that the fact that all items were not attempted does not mean that the trainees (or their instructors) simply chose the easier items. Rather, it reflects the fact that (a) time constraints and training schedules differed across sites so that some exercises were not reached by some students, (b) student needs for training vary and therefore certain exercises might be inappropriate--this is particularly true for the younger students and exercises relating to environmental sensing and travel in business districts, and (c) instructors were advised not to undertake in either the pretest or posttest any exercises which they felt could present any risk to the trainee in terms of his or her level of developed skills.

In the light of the above discussion, it is appropriate to examine (at least briefly) the extent to which the trainees were actually able to achieve the broad range of criterion items included in the materials. Dividing the number of posttest "Yes" items by the total number of possible items would indicate that a 77.3% achievement level was reached. This is still a very acceptable figure when one considers the conservative nature of this finding--that is, when individual developmental level is taken into account.

A number of other criterion items in the performance exercises were numerical in nature, and could not be answered in a dichotomous "Yes-No" manner. Numerical entries were either counts of the number of contact errors (with cane or body), or the elapsed time to complete a task, or indications of the detection of elements in the environment (such as pedestrians or landmarks). Table 6 shows the results for the numerical assessments for those persons on whom both pretest and posttest scores were available. Improvement was shown on 79.6% of the tasks attempted.

As in the case of "Yes-No" items, trainees were not required to attempt all items. When the number of numerical items available is divided into the number of items for which an improvement is shown, a 61.7% achievement figure is obtained.

TABLE 6

Aggregated Performance on
Numerical Criterion Items

Number of Items in Materials	Number Attempted Both Pre and Post	Number Showing Improvement	% Success
196*	152	121	79.6%

*28 items actually appear in the materials. This represents the aggregate of items across all trainees.

In interpreting these results it is especially important to keep in mind that an individual who had (for example) zero contact errors in the pretest and zero on the posttest would not be counted as showing improvement. Practically, of course, this individual could not improve on that item and indeed need not improve on it. Thus, in terms of absolute performance, the percent of success shown in Table 6 is quite conservative.

It would appear that, at least for the limited number of trainees on whom pre- and post-data were available, the use of ETAs made a substantial difference in their ability to sense environmental stimuli, interpret those stimuli, and react appropriately on a variety of specific tasks.

Instructional Outcomes

The ability to achieve a specific task, such as detecting and avoiding a path-blocking pedestrian, can be facilitated by an ETA. Instead of bumping the pedestrian with the blind individual's cane or body, it is possible that the ETA can be used to signal the presence of an object in the path in ample time for the blind traveler to take evasive action.

Realistically, no ETA is going to make a blind traveler perform faultlessly and a certain number of contact errors may still be encountered. The question of instructional outcomes and improved performance, then, rests not solely on whether isolated tasks were accomplished but whether types of tasks were accomplished repeatedly and over a variety of situations, thereby indicating an increased ability to apply a generalizeable skill.

Eleven types of skills were reflected in the various items in the pre- and post-mastery tests. These skills represent a set of instructional outcomes toward which ETA training is often directed. Table 7 shows the instructional outcomes for the trainees who participated at the prototype ESSETS sites.

Without regard to any differential effects and benefits that might have resulted among the different ETAs, it is clear from the results shown in Table 7 that

- fairly high success was shown on the posttest as compared to the pretest. Postest results ranged from 83.5% to 100% success on attempted items within the eleven categories, while the range on the pretest was 21.7% to 76.9%.

- fairly high achievement was shown on the posttest as compared to the pretest. Posttest results ranged from 65.2% to 85.7% achievement of all items included in the materials, as compared to a range of 19.6% to 57.1% on the pretest.

TABLE 7

Results for Eleven Types of Instruction Outcomes

INSTRUCTIONAL OUTCOMES	Total No. of "Yes-No" Items (all levels, all subjects)	PRETEST				POSTTEST			
		Number of Items Attempted	Number of Items Achieved "Yes"	% Success (col. 3 ÷ col. 2)	% Achievement (col. 3 ÷ col. 1)	Number of Items Attempted	Number of Items Achieved "Yes"	% Success (col. 7 ÷ col. 6)	% Achievement (col. 7 ÷ col. 1)
	col. 1	col. 2	col. 3	col. 4	col. 5	col. 6	col. 7	col. 8	col. 9
Ability to travel with increased efficiency and safety	189	165	61	37.0	32.3	161	153	95.0	81.0
Avoidance of obstacles	126	106	23	21.7	18.3	105	102	97.1	81.0
Ability to use public transportation	28	26	13	50.0	46.4	24	22	91.7	78.6
Ability to establish and maintain orientation	154	128	52	40.6	33.8	126	120	95.2	77.9
Use of landmarks	112	83	22	26.5	19.6	81	73	90.1	65.2
Ability to transfer environmental elements recognition among typical environments	2[illegible]	26	20	76.9	71.4	23	23	100.0	82.1
Increased control in interactions with sighted public	91	76	31	40.8	34.1	85	71	83.5	78.0
Use of ambient sound	42	36	24	66.7	57.1	36	36	100.0	85.7
Ability to travel with a minimum of deviant peripatetic behavior	42	37	21	56.8	50.0	36	36	100.0	85.7
Ability to control/ correct veer	77	73	33	45.2	42.9	73	66	90.4	85.7
Use of/interaction with shoreline	161	118	41	34.7	25.5	118	116	98.3	72.0

Carrying through our earlier comparison of Trainees M. F. and J. J., it is interesting to note that J. J. (who had somewhat lower scores in trials with the devices) scored 100% success as regards instructional outcomes 2, 4, 6, 7, 8, 9, 10, and 11. He scored in the mid-90% range on instructional outcomes 1 and 5, but had only 75% success in instructional outcome 3 relating to use of public transportation. (This latter could reflect his younger age and somewhat rural environment.)

M. F., on the other hand, scored 100% success on instructional outcomes 3, 6, 8, 9, and 11. He scored 94% on outcome 1; in the 80%-89% range on outcomes 2, 4, 5, and 7; and 78% on outcome 10, which related to controlling and correcting veer.

Relative to their starting points, J. J.'s accomplishments following training seem surprisingly high as compared to M. F.'s accomplishments, though both did very well overall.

Post-Training Trainee Interviews

At the end of training, each student was asked a number of questions that were designed to elicit his or her general feelings about the training program and the ETA which that person had learned to use. Table 8 summarizes the results of this interview for five of the seven trainees. (Two trainees had not yet completed all their training and were thus not yet interviewed.)

Uniform positive responses were given by the participants to (#1) being satisfied with the results of the matching process, (#2) feeling the training was appropriate to individual needs and abilities, (#4) being able to operate the device, and (#5) being more confident in familiar environments. Four of the five trainees also felt (#6) more confident in unfamiliar environments, (#7) more confident outdoors as well as indoors, and (#13) annoyance at the prospect of not having the device available for personal use.

Only in one question was there a "negative" majority. That had to do with whether the trainee had developed uses for the device other than O&M purposes. It is not unreasonable to assume that this question might also have had a "positive" majority had the participants had more time to explore the potential of the ETA outside of the training context.

TABLE 8

Summary of Post-Training Interviews for
Five of Seven Trainees

Questions	Responses Yes	No
1 Does trainee express satisfaction at having been matched with this device rather than any other device?	5	0
2 Does trainee feel that the type of training he received was appropriate to his needs and abilities?	5	0
3 Does trainee feel that the training has enabled him to function more independently than previously?	3	2
4 Does trainee express confidence in his ability to operate the device?	5	0
5 Does trainee describe himself as a more confident traveler in familiar environments?	5	0
6 Does trainee describe himself as a more confident traveler in unfamiliar environments?	4	1
7 Does trainee indicate more confidence in his ability to travel indoors as well as outdoors?	4	1
8 Does trainee plan to continue using the device on a daily or regular basis?	3	2
9 Does trainee plan to use the device often for school or work applications?	3	2
10 Does trainee plan to use the device often for leisure applications?	3	2
11 Has trainee developed any uses for the device beyond orientation and mobility?	2	3
12 Does the trainee feel the device has helped him develop new or better relationships with others?	2	2
13 Would the trainee be frustrated or annoyed if he no longer had the device available for his personal use?	4	1

Case Studies

The cases of M. F. and J. J. have been mentioned earlier in the Results section in order to illustrate the way in which different persons can be expected to show interesting variations in scoring on the Selection, Matching, and Attained Performance evaluations. Brief mention was made of their response to ETA training and final interview results. In both instances the Laser Cane was the ETA taught.

In the case studies which follow emphasis will be given to how two college students (at different campuses) responded to training with different ETAs, together with a summary of their background. The ETAs used by these two trainees were the Sonicguide (Trainee R. C.) and the Mowat Sensor (Trainee D. J.).

Trainee R. C.

Trainee R. C. is male, lives with sighted persons in a dormitory, and attends college. He has been blind since birth and it was caused by retrolental fibroplasia. R. C. has no additional handicaps. He travels with a long cane and unescorted in the areas of his home, school, the neighborhood, and when shopping.

Trainee R. C. scored high in performance on all the devices but his interview results only produced high ratings for the Sonicguide. It was a clearly preferred device and he therefore received training with it.

Trainee R. C. required no remedial training in terms of cane technique, awareness of environmental elements, and functional knowledge of compass techniques. He received 87 hours of training spanning a five-month period. Notes in the Progress Log for Level 1, Controlled Environment Training, show that Trainee R. C. independently achieved six tasks in equipment manipulation and terminology in the first week. He then took approximately one month to independently associate ETA signals with particular environmental factors as based on seven different classes of object-signal associations. Within the same approximate time-frame he also independently achieved 6 of 8 training tasks involving interpreting and acting upon environmental events. Within another week and a half to two weeks, he independently achieved 5 of 8 training tasks involving interpreting ETA information and reacting within complex and dynamic situations. The instructor's remarks were extremely optimistic and complimentary about R.C.'s ability to receive and apply instruction immediately, even including tranference from one situation to another. The student felt that the Sonicguide was "fun" and seemed curious about what it could potentially do. At this point, he did not feel he would own one but was open to discovering its possible applications.

The Progress Log for Level 2, which pertains to residential and school-campus travel, showed training in a wide variety of applications. These included the route to classes, the route to a bank, neighborhood orientation, avoiding bushes and trees in residential areas, a new route to the trainer's office, orientation to a dormitory, learning of new

streets around the campus, travel to a sporting goods store near campus, travel to an electronic shop to have a tape recorder fixed, and travel to a clothing store to buy a shirt. The instructor continued to comment on R. C.'s rapid ability to interpret Sonicguide signals and react accordingly, and commented on his ability to blend the Sonicguide and other mobility skills in a complementary way. The trainee impressions at this point reflected a considerable degree of self-confidence and relatively little of the credit was attributed to the effects of the Sonicguide. Level 2 training spanned about one month.

The Progress Log for Level 3 concerned training in small business and community travel. Travel problems included the inside and outside of a record store, external aspects of a bank (teller window and deposit drawer), inside of a supermarket, the area surrounding a city hall, inside of a post office (including locating the end of a line), orientation to a radio supply store, travel to a butcher shop which was accessed from a parking lot, and going to community college classes beyond his present travel boundaries. The instructor's remarks note that the trainee "is becoming very creative with the Sonicguide." It is indicated that he hears differences in sound that the instructor is unable to distinguish and is very adept at avoiding obstacles and pedestrians. The trainee still felt the accomplishments are largely his and not due to the Sonicguide. The training in this level was about two weeks in length.

Progress Log Level 4 was related to medium busines and metropolitan business travel. Training activities involved sessions concerned with downtown pedestrian traffic, traveling long routes, crossing at lighted intersections, crossing at off-set and T intersections, dealing with special corners and entrances (verandas, pillars, sliding doors), grocery store product locations, unfamiliar route to a church, and an unfamiliar route to a doughnut shop. Instructor remarks indicated that the Sonicguide seemed to have enhanced what the trainee could do and made this process quicker and more effective. He is able to tell about the environment a lot sooner. The trainee still felt the Sonicguide was "fun" but not something he needed. Training in this level spanned ten days.

Progress Log Level 5 dealt with creative and lifestyle-relevant applications of the ETA. The trainee was very interested in outdoor activities, possibly involving future work with the Park Service. Early in the project he attempted hiking in the woods with snowshoes. He followed the instructor and then walked by himself. He was able to dodge trees and branches successfully. Three months later, he again hiked in the woods when there was no snow. His progress was slower due to the underbrush he encountered. He was able to hike independently without a trail and kept oriented using the sun and his line of travel.

When Trainee R. C.'s posttest results are compared with the pretest, it is evident that his skills improved in a number of instructional outcomes. The brief summary below lists the eleven instructional outcomes and Trainee R. C.'s percentage of success on the pretest as compared to the posttest. (Note that "% of Success" reflects the number of items achieved from among those items attempted.)

Instructional Outcomes	% of Success - R.C.'s Pretest	% of Success- R.C.'s Posttest
Ability to travel with increased efficiency and safety	66.7	92.6
Avoidance of obstacles	61.1	94.4
Ability to use public transportation	75.0	100.0
Ability to establish and maintain orientation	50.0	95.5
Use of landmarks	37.5	87.5
Ability to transfer environmental elements recognition among typical environments	100.0	100.0
Increased control in interactions with sighted public	61.5	92.3
Use of ambient sound	83.3	100.0
Ability to travel with a minimum of deviant peripatetic behavior	100.0	100.0

Instructional Outcomes	% of Success-R.C.'s Pretest	% of Success-R.C.'s Posttest
Ability to control/ correct veer	72.7	90.9
Use of/interaction with shoreline	69.6	100.0

For those performance exercises that dealt with numerical entries, which included contact errors, elapsed time, and environmental detections, Trainee R.C.'s results were as follows:

- Improvement was shown on 3 of 10 items relating to contact errors.
- Improvement was shown on 2 of 6 items relating to elapsed time.
- Improvement was shown on 8 of 11 items relating to environmental detection.

On the subjective reactions, expressed in an interview following training, the trainee's remarks were as follows:

Question	Answer
Does trainee express satisfaction at having been matched with this device rather than any other device?	Yes
Does trainee feel that the type of training he received was appropriate to his needs and abilities?	Yes
Does trainee feel that the training has enabled him to function more independently than previously?	No
Does trainee express confidence in his ability to operate the device?	Yes
Does trainee describe himself as a more confident traveler in familiar environments?	Yes
Does trainee describe himself as a more confident traveler in unfamiliar environments?	No
Does trainee indicate more confidence in his ability to travel indoors as well as outdoors?	Yes
Does trainee plan to continue using the device on a daily or regular basis?	No
Does trainee plan to use the device often for school or work applications?	No

Question	Answer
Does trainee plan to use the device often for leisure applications?	No
Has trainee developed any uses for the device beyond orientation and mobility?	Yes
Does the trainee feel the device has helped him develop new or better relationships with others?	No
Would the trainee be frustrated or annoyed if he no longer had the device available for his personal use?	No

Following graduation from college, Trainee R. C. left town and at that time still felt that he did not need the Sonicguide on a personal basis in spite of his evident success in its use. It is strictly conjectural whether he would change his mind at some later date.

Trainee D. J.

Trainee D. J. is male, lives alone, and attends college. His blindness occurred three years ago due to diabetic retinopathy. He has light perception in both eyes but no measurable acuity. Apart from his diabetes he has no other handicaps. He uses a long cane for travel, has had brief previous training with the Laser Cane, but plans to get a dog guide in the future. He travels unescorted in the home, school area, neighborhood, and when shopping.

At the time of the Matching Trials with the different devices, D. J. scored high in performance on each of them, and in the interview had a moderately positive feeling toward the Nottingham Obstacle Detector, the Laser Cane and the Mowat Sensor. In view of his anticipated acquisition of a dog guide, a hand-held device seemed to be more practical, thus the Laser Cane was eliminated and the Mowat was selected.

Trainee D. J. required no remedial training in terms of cane technique, awareness of environmental elements, and functional knowledge of compass directions. He received 22 hours of training with the Mowat Sensor spanning a three-month period. Notes on Progress Log Level 1, Controlled Environment Training, show that Trainee D. J. achieved six tasks in equipment manipulation and terminology in one day. He then took an additional week to cover seven tasks involving the association of ETA signals with particular environmental factors, such as different types of objects. In two more weeks he had accomplished eight tasks relating to interpreting and acting upon environmental events. In an additional week he had completed the eight tasks associated with interpreting ETA information and reacting within complex and dynamic situations. The instructor's comments at this point indicate that the Mowat is "very easy" for D. J. and that he has already used it in school. The trainee expressed amazement at how much more "fluent" a traveler he was in such a short time (seven weeks had elapsed at that point).

The Progress Log for Level 2, relating residential and school-campus travel, showed that training had occurred in three situations. These included training in locating a bus stop to facilitate school-to-home travel, navigating through the grounds of a townhouse complex, and training in a college

building that involved obstacle and pedestrian avoidance and the location of classrooms by detecting openings. The instructor noted that the student developed a more detailed picture of the size and placement of objects in the home area and could travel in school with the Mowat as a primary aid, inasmuch as he had confidence in the device and prior familiarity with the surroundings. The trainee commented that verbal familiarizations offered by sighted people become more meaningful because the objects are detectable.

The Progress Log for Level 3 covered small business and community travel. Training included practice in accessing a supermarket and in performing object identification tasks (shoppers, carts, and checkout stands) inside the supermarket. Similar training was conducted in relation to a drugstore. The instructor noted that D. J. was moving more smoothly and was better able to avoid obstacles in these locations. He was also able to locate aisles and the end of aisles more easily. The trainee commented that he was pleased with the safety features that the device seemed to offer, remarking that these places used to be hazardous places to travel.

Progress Log Level 4 was related to medium business and metropolitan business travel. Training activities included locating and utilizing a restaurant, and gaining access to a large hotel when signal lights, "blended" curbs and a T-intersection were involved. Training was also provided in congested downtown areas (involving use of the range switch on the Mowat) to locate crowds of people, trees, and other obstacles. Practice in an airport took place, including location of the reservation desk and boarding gate, and making effective use of assistance. The instructor commented that D. J.'s independent trips were now accomplished more easily. The trainee remarked that he felt he made a better impression on others because of less probing and collisions. He also felt that it made a better impression in his part-time job, raising the possibility that other blind students might be hired.

The Progress Log for Level 5 dealt with creative and lifestyle-relevant applications of the ETA. It was noted that in portions of the community lacking sidewalks (approximating rural travel) the trainee was able to travel in a straight path by following shoreline cues. Shopping for groceries was accomplished with relatively few cane contacts and an easier location of

a checkout counter. His on-the-job performance improved with the result that the trainee was very pleased about the impression he was making on others.

When Trainee D. J.'s posttest results are compared with the pretest, it is evident that his skills improved on a number of instructional outcomes. The brief summary below shows his percentage of success in these two testings.

Instructional Outcomes	% of Success-D.J.'s Pretest	% of Success-D. J.'s Posttest
Ability to travel with increased efficiency and safety	61.5	96.2
Avoidance of obstacles	41.2	100.0
Ability to use public transportation	100.0	100.0
Ability to establish and maintain orientation	76.5	94.1
Use of landmarks	50.0	75.0
Ability to transfer environmental elements recognition among typical environments	100.0	100.0
Increased control in interactions with sighted public	61.5	100.0
Use of ambient sound	100.0	100.0
Ability to travel with a minimum of deviant peripatetic behavior	100.0	100.0
Ability to control/ correct veer	90.9	90.9
Use of/interaction with shoreline	69.2	100.0

For those performance exercises that dealt with numerical entries, Trainee D. J.'s results were as follows:

- Improvement was shown on 6 of 10 items relating to contact errors.
- Improvement was shown on 4 of 4 items relating to elapsed time.

- Improvement was shown on 9 of 10 items relating to environmental detection.

In terms of subjective reactions, expressed in an interview following training, the trainee's remarks were as follows:

Question	Answer
Does trainee express satisfaction at having been matched with this device rather than any other device?	Yes
Does trainee feel that the type of training he received was appropriate to his needs and abilities?	Yes
Does trainee feel that the training has enabled him to function more independently than previously?	No
Does trainee express confidence in his ability to operate the device?	Yes
Does trainee describe himself as a more confident traveler in familiar environments?	Yes
Does trainee describe himself as a more confident traveler in unfamiliar environments?	Yes
Does trainee indicate more confidence in his ability to travel indoors as well as outdoors?	Yes
Does trainee plan to continue using the device on a daily or regular basis?	Yes
Does trainee plan to use the device often for school or work applications?	Yes
Does trainee plan to use the device often for leisure applications?	No
Has trainee developed any uses for the device beyond orientation and mobility?	No
Does the trainee feel the device has helped him develop new or better relationships with others?	No
Would the trainee be frustrated or annoyed if he no longer had the device available for his personal use?	Yes

Trainee D. J. has requested that a Mowat be made available to him on a personal basis. Action has been initiated through the Department of Rehabilitation to purchase one for him. It is considered likely that he will obtain the device and use it if he enters a career in public relations.

Site Continuations and Dissemination

Site Continuations

From the outset of the project, when sites were selected, the question of continuation of the ESSETS approach (in some form) at each training center after the grant ended was a matter that had been considered. If a site was clearly not willing to entertain thoughts of continuation, the rationale for including it would be very weak. On the other hand, if the system proved unworkable and tedious, it would not be worthy of continuation at the cooperating sites. That is not to say, of course, that continuation was independent of other things--most notably, (1) available instructor time from a certified ETA trained instructor and (2) a clear plan for supplying equipment to persons receiving ETA training.

As it turned out, the instructors agreed that the ESSETS materials were easy to complete and generally helped them to avoid overlooking important training and evaluation considerations. As expected, there were aspects of the prototype materials that needed deletion or modification to make them "leaner" and even easier to use.

A more perplexing problem, and one that could not be totally resolved in the study, was the means by which equipment could be made available to trainees following training. In this regard, it should be kept in mind that equipment complements were deposited at the sites for training purposes only, and following communication of our intent to the Project Officer, were left with the cooperating sites until such time as these ETAs might be recalled by the government. To meet the needs of trainees within the project, two strategies were followed: one site applied for Department of Rehabilitation funding, while another site emphasized community appeals and fund-raising. In this latter instance, the techniques included a theatre showing of Butterflies are Free (with proceeds donated), a community bake sale, church fund raisers, and a Lions Club benefit. (See Appendix D for newspaper coverage of the need, followed by the outcome of the fund-raising for one participant.) Realistically, the extensive effort expended in this latter approach would make it awkward to sustain a continuing program in this manner.

Three of the four sites indicated an intent to continue using the ESSETS approach when appropriate candidates for training were available. The fourth site lost its ETA instructor and had no plans to continue with ETA training at all.

One aspect of continuation at the sites bears special mention. It would seem fair to say that the ESSETS approach in no way substitutes for regular O&M training, and that electronic travel aid instruction may not be appropriate for many trainees. Thus, implementation of ESSETS does not automatically mean that more time is needed from ETA certified instructors or that more ETAs should be supplied. Rather, it suggests that by using the systematic screening approach of ESSETS instructor time would be more efficiently used, and that trained students more likely would be deserving of their own ETAs.

Dissemination

This study concentrated on developing the ESSETS approach, which emphasizes a standard set of procedures that can be readily accommodated in a wide variety of locations. For its potential to be realized, however, dissemination is needed and technical assistance offered both in its implementation and in the pooling of information that it is designed to produce.

To set this dissemination in motion, several steps were taken during the course of the project. First, each site has been encouraged to share their experience and knowledge with other organizations in their area.

Second, project staff have made presentations acquainting professionals with the status of the work. This has included presentations to colleagues in rehabilitation and orientation and mobility training at a conference on low vision, sponsored by the American Foundation for the Blind, and to international educators at the First World Congress on Special Education, held in Scotland and sponsored by the Council for Exceptional Children.

Third, a limited number of additional copies of the final, revised ESSETS materials were prepared with a view to encouraging interested organizations to adopt the approach. Specifically, the plan is to provide a complimentary set to an agency if it is understood that the obtained data would be shared

for subsequent research purposes (with trainee anonymity assured). It is anticipated that other copies would be available on a cost recovery basis for any organization that does not wish to be involved in the data-sharing aspect of the ESSETS approach.

DISCUSSION

This study was essentially concerned with developing a prototypic system for the assessment of blind persons who are potential users of electronic travel aids, for matching them with appropriate devices, and monitoring their achievement of environmental sensing skills as a result of training. It involved development and pilot testing of the materials in "real life" training applications, involving school and college level students at cooperating sites in three states.

Because of the limited nature of the field tests and difficult local circumstances (particularly delays due to staffing factors at the sites which constrained the amount of ETA instructor time that was available) relatively few trainees completed all facets of the training. Thus findings relating to student outcomes should be considered preliminary, to be supported (hopefully) by future findings on an expanded number of cases.

With these factors in mind, it nevertheless seemed clear that

- the ESSETS materials proved workable in the field, even in their prototype form prior to revision;
- the students who participated in the study seemed to find the experience satisfying and were able to accomplish many more tasks successfully with their ETAs than without them;
- the structure of the materials apparently facilitates instructor judgments at times when decisions about training are being made and conclusions are being made about the trainee's attained performance.

An interesting aspect of this study was the importance of having the student share in the choice of the ETA. Even where trials were "just as good" with different devices the trainee's feelings played an important part. In this study, for example, the Pathsounder was available at each site, was tried out by the trainees, and generally used with facility, yet none of the students preferred it. In that regard, it should be kept in mind that none of the students had physical/medical problems that precluded hearing audible signals or holding tactile devices in their

hands while also manipulating their canes. Had the youngest student, S. J. (a primary student), continued in the study, he probably would have been a Pathsounder trainee. For purposes of this study, of course, forcing persons to select certain equipment for research purposes would have been antithetical to the basic goal of the study.

One challenging and supremely important issue verified in this study is the problem of assuring that trainees receive equipment for personal use once they have demonstrated an ability to use it to advantage. Lacking clear, uniform procedures for acquiring the needed equipment such as could be Federally implemented, instructors are faced with a practical deterrent to undertaking ETA instruction. Certainly this cheats qualified candidates of "equal opportunity" as mandated in Federal legislation. While means can be found to purchase equipment through diligent instructor effort, this is not conducive to the best use of their professional talents and is tangential to the objective procedures recommended in the ESSETS approach. Just as sites in this study were faced with this practical consideration, future sites that adopt the approach should do so with a plan in mind that complements the careful evaluation and training recommended in ESSETS.

It was not and is not appropriate for the ESSETS materials to specify the amount of training that a given trainee/ETA combination require. Indeed, the ESSETS evaluation activities will be the best indicator of when a trainee is ready to "graduate." There was considerable variation in the study both in the way that trainees and instructors got together for training and in the frequency and length of their sessions. Nevertheless, it was apparent to AIR that each instructor felt "pressed" for time, and that other commitments and agency priorities sometimes prevented continuity in instruction. While such conflicts and shifts in priorities are inevitable to some degree, it is reasonable to assume that it is disadvantageous to efficient learning. Accordingly, the study results might be viewed as conservative. It is thought that future sites that elect to use ESSETS should give serious consideration to the programmatic planning of the instructor time needed to implement it effectively.

In terms of the student data and exepriences of instructors in the field, there can be a considerable amount of growth in skill as an individual moves through the various training levels, and there is apt to be wide diversity in the kinds of training situations utilized. Because training and assessment should be integrated and complementary activities in an ESSETS program, it seemed appropriate that interim or "progress" assessments should be made. This led to AIR's decision to revise the ESSETS materials and thus to provide three levels of instruction and assessment.

RECOMMENDATIONS

Based on the preliminary findings derived from field tryouts of the ESSETS materials and procedures with electronic travel aids, it is recommended that:

- Electronic travel aids should be made available to secondary- and college-level students who demonstrate that they can substantially benefit from them. This implies that (a) alternative devices should be available for consideration and trial at training sites throughout the country, (b) evidence should be gathered to support the particular person/device match-up as well as trainee skills that are developed, and (c) personal use devices should be provided to qualified trainees through some systematic funding avenue rather than through individual instructor effort.

Based on the field tryouts, it is recommended that:

- The ESSETS materials, consisting of four interrelated documents, should be used by schools and colleges who feel that individual capabilities and attitudes among blind students should be taken into account when decisions are made regarding ETA training. This implies that costs for the documents should be held at reasonable levels in order that copies can be provided to each qualified ETA instructor. Several of the documents will be consumed during the course of evaluation and training for each student and therefore should be available for each trainee.

Based on the potential benefits to be realized, it is recommended that:

- Funding should be made available from Federal sources to support the establishment and operation of an ESSETS Technical Assistance Center or similar functioning unit. This implies that (a) ongoing support should be made available to adopting sites, including instructor workshops, site-center communication linkages, advisory

assistance, etc.; (b) trainee performance should be collected and aggregated in a data file on a longitudinal basis; and (c) periodic analyses of the data should be undertaken on basic questions of importance to instructors, equipment developers and researchers involved in studies of environmental sensing by the blind.

Based on a general appraisal of the current status of training centers in the field, it is recommended that:

- More orientation and mobility instructors should become certified to teach each of the various electronic travel aids on the market place. This implies that schools and colleges (and agency training centers) that lack such qualified instructors should take the initiative to have selected staff upgraded through specialized ETA courses at universities offering such programs.

APPENDIX A

Excerpts from the Revised Compendium

TOPICAL AREA IV

RELATING PERSONAL MOVEMENT TO DISTANCE, TIME, AND RATE

WORKING DEFINITION

Estimating one's temporal and physical distance from a destination through knowledge of the interrelationships of rate of travel, distance of travel, and time.

RATIONALE

It is necessary to relate travel rate, distance traveled, and time, in order to: plan a reasonable schedule for the purpose of arriving at a destination at an appointed time; estimate the distance one has traveled along a route by relating a landmark to a specific point on that route; estimate the distance that has been traveled upon completion of a new route.

EFFECTIVE BEHAVIOR

It is important for Suzanne to catch the 1:45 bus at its stop several blocks from her home. *Usually it takes her twenty minutes* to get to the	*A1*
bus stop, but today, *since her four-year-old son will be with her, she decides to allow thirty minutes*, and leaves her house at 1:15. On the	*C1*
way, the child's pace is slow and he stops to ask questions about almost everything they pass. Suzanne *begins to feel anxious* about missing the	*A2, B2*
bus despite the extra margin of time, and wonders if she should hurry her son, though she hates to discourage his curiosity. Just then she *crosses a familiar section of sidewalk* where the pavement	*B1*
has been pushed up by a tree root so that it forms a noticeable incline. *At this point in the route she knows she is about one block, or three minutes away* from the bus stop when traveling at	*A1*
her normal rate. *Checking her watch, she is surprised to find it is only 1:35*. She relaxes,	*A1, 2*
knowing they have covered more than half the route in 20 minutes. They arrive at the bus stop at 1:40, with five minutes to spare.	*B1, C1*

• • •

SKILLS EFFECTIVELY APPLIED IN EXAMPLE

A Estimating elapsed travel time and anticipating needed travel time

B Estimating the distance traveled or to be traveled

C Estimating the rate of travel

REQUISITE SKILLS AND BEHAVIORS

A. Estimating needed or elapsed travel time

1. Factors contributing to the estimation of necessary or elapsed travel time
   a. use of a clock or watch
   b. information gained through repeated experience
   c. interpretation of cyclic environmental events while traveling (e.g., movement of sun)
   d. sensitivity to one's biological clock while traveling
   e. information from sequence, duration, or tally of environmental elements or events (e.g., a change in traffic flow at a signal light known to change every 30 seconds)
   f. division of travel distance by rate of travel
   g. counting units of time to oneself while traveling

2. Factors affecting the estimation of elapsed time or needed time
   a. level of motivation (e.g., the more motivational one's activity, the more quickly time seems to pass)
   b. level of activity (e.g., the more active one's involvement, the more quickly time seems to pass)
   c. level of stress (e.g., the more stressful the task, the more one's sense of its duration is likely to be distorted)

GLOSSARY (excerpt)

Travel aid, secondary
: A supplemental travel aid, including a number of electronic devices which are meant to be used in combination with a primary aid in order to enhance perception of the environment, facilitate travel performance, or assist in particular situations where the primary aid would be less efficient

Travel path
: An implied line connecting point of origin and point of destination

Travel vector
: A direction of travel of a particular amount

Typical alignment
: The positioning of body parts naturally assumed by an individual in a given circumstance

Unfamiliar route
: A route over which one has not previously traveled, or for which one has no cognitive map

Veering
: Deviation to the left or right of a straight, forward line while traveling

Verbal familiarization (also, "verbal orientation")
: A verbal description which includes sufficient information about an object, area, route, or task to make it understood

World orientation
: A state of awareness that relates the individual's position to a geographic location

INDEX (excerpt)

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Perception of, 23*(B4)*, 67*(F3)*
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ENVIRONMENTAL ELEMENTS AND OBJECTS
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Identification of

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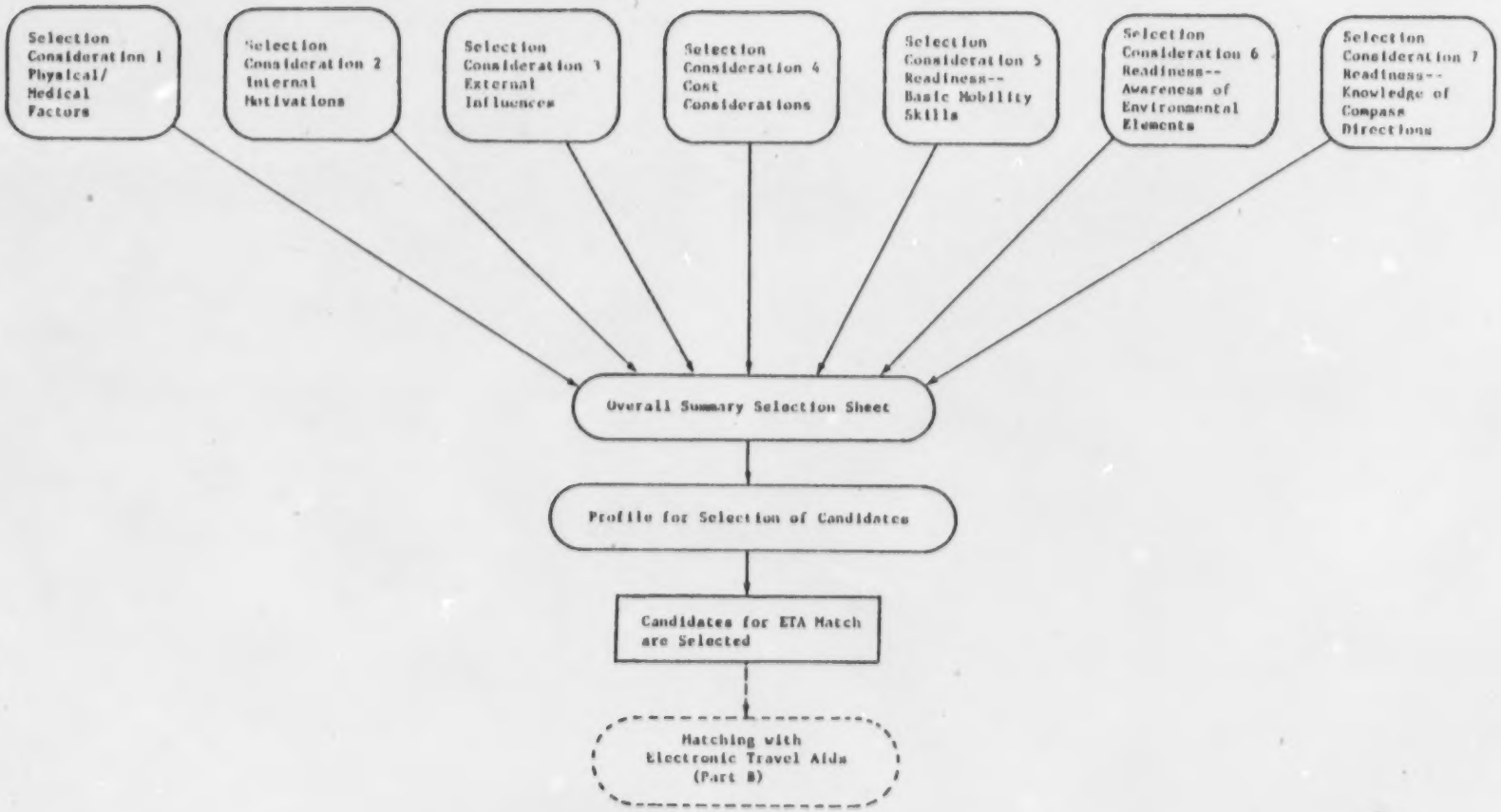
Soliciting Aid, 70*(I1,2)*
Tracking Pedestrians, 65*(E6c)*

APPENDIX B

Process Diagrams and Excerpts from the
Revised Selection and Matching Module

SELECTION STRATEGY


Selection Consideration 1 Physical/ Medical Factors
Selection Consideration 2 Internal Motivations
Selection Consideration 3 External Influences
Selection Consideration 4 Cost Considerations
Selection Consideration 5 Readiness-- Basic Mobility Skills
Selection Consideration 6 Readiness-- Awareness of Environmental Elements
Selection Consideration 7 Readiness-- Knowledge of Compass Directions
Overall Summary Selection Sheet
Profile for Selection of Candidates
Candidates for ETA Match are Selected
Matching with Electronic Travel Aids (Part B)

B-1

CONSIDERATION 2 • INTERNAL MOTIVATION (S2)

Limitations: While the positive effects of motivation are well known, it is not yet established whether persons who already travel successfully without ETAs will be highly motivated to use them on a regular basis.

Rationale: The individual who is self-motivated, independent, and persistent in his approach to things is likely to approach ETA training with a high degree of determination.

Examiner Instructions: Give your best judgement for each of the following questions regarding candidate for ETA matching.

Note: If the examiner wishes assistance in answering these questions, it may be helpful to check with all or some of the following:

- the student's regular O&M instructor
- the student's resource room teacher
- the student's classroom teacher(s)
- the student's counselor
- the student's family
- the student's employer

Scoring and Interpretation: "Yes" or "no" scores should be entered in the blank to the right of each checklist item. After completing all the items, count all the "yes" scores only, and fill in the appropriate "Total Score" blank at the bottom of the scoring column. The student's status as a candidate for ETA match and instruction, as suggested by this total score, is indicated beneath the "Total Score" entry.

General Motivation Indicators

Does the student demonstrate the ability to be assertive/aggressive when the situation warrants? _____ (01)

Does he demonstrate persistence of goal orientation in the face of adversity? _____ (02)

Does he demonstrate an inclination toward self-improvement? _____ (03)

Does he demonstrate an eagerness to make his own decisions and choices? _____ (04)

Does he make a real effort to be independent? _____ (05)

Has he indicated job/career aspirations? _____ (06)

O&M Specific Motivation Indicators

Would he travel on his own for reasons other than necessity? _____ (07)

Is he, or does he wish to be an independent traveler? _____ (08)

Does he satisfactorily cope with unwanted assistance/attention from the general public? _____ (09)

Does he sometimes express a desire to broaden his travel boundaries? _____ (10)

Would he show responsibility in caring for a travel aid? _____ (11)

ENTER TOTAL SCORE _____ (12)
(Check appropriate level)

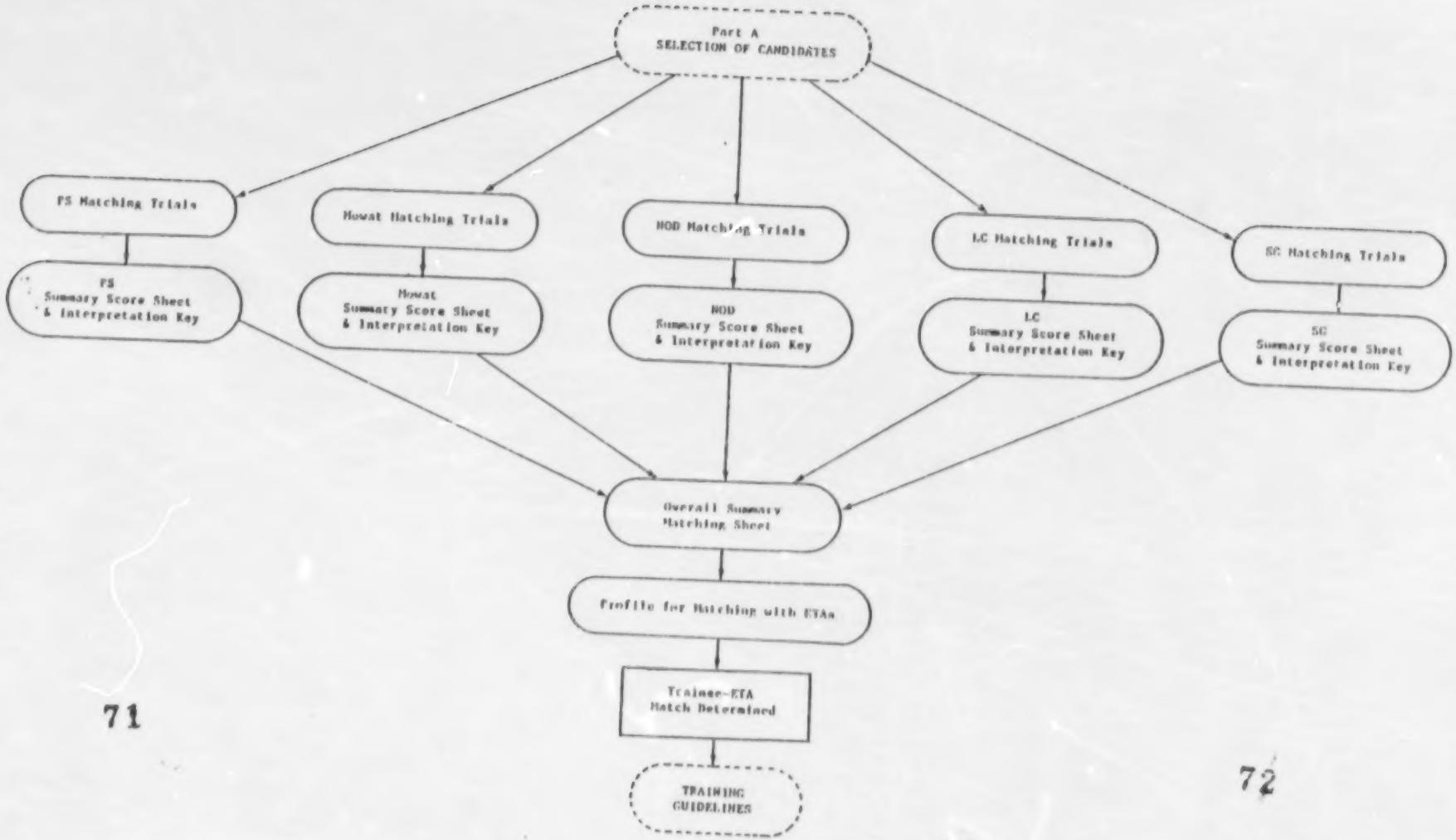
HIGH ☐ 8-11

MODERATE ☐ 5-7 (13)

70

LOW ☐ 0-4

MATCHING STRATEGY



B-4

Description of the Matching Trials

Matching trials are not tests in the usual sense of the word. Rather, they are structured experiences which afford the candidate a chance to try the device in both simple and semi-complex applications before extensive training takes place. Accordingly, it is generally recommended that the trials be followed in sequence, in their approximate order of complexity. Note that test and retest opportunities are given for the trials. This can help to establish whether too little familiarization with the task may have contributed to the individual's inability to carry out the exercise. Between the test and retest, however, the instructor should refer to the appropriate "Helping Steps" located at the end of each section. After the Matching Trials are completed for each device, transfer the results to the Overall Summary Matching Sheets that follow the last Matching Trial. Then use information from the Overall Summary Sheet to fill out the Profile for Matching at the end of PART B.

The following page gives an example of one Matching Trial (for the Laser Cane) as it would be filled out for a hypothetical candidate. In this case, the individual was retested after Helping Step 5a had been used. A brief comment has been entered to explain the difficulty on the first trial (test).

What can be learned from the Matching Trials? Not only will it be possible to establish overall scores for each device, which are entered on the Summary Score Sheets, but it will be possible to form some idea of which devices are quickly learned and easily put to practical use as well as which devices the individual seems to prefer.

NOTE: The trainee's long cane will not be used in Matching Trials except in those Matching Trials where it is specifically requested in the Equipment box.

Example

MATCHING TRIAL: 5

(M4)

Setting: Indoor. Large obstacle-free room (e.g., gym).

Conditions: After 5 minutes of instruction and practice in paralleling a wall via forward signal use, the trainee will try to parallel a wall for 25', stopping when upward and forward signal combination informs him that he is about 3' from a perpendicular wall. The trainee will then turn and try to align parallel with the wall that was perpendicular as he walks forward for about 25'. The LC range will be set at 3'.

Purpose: 1) Test trainee's ability to parallel a shoreline through interpretation of LC signals.
2) Test trainee's ability to align parallel with a shoreline, through interpretation of LC signals.

Equipment

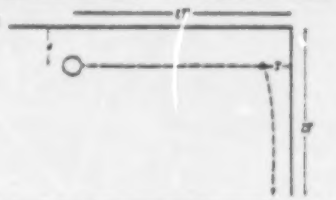
(LC)

Test Date: 9/6/78
Re-Test Date: 9/13/78

Specify 'Helping Steps' Used: 5a, b

(E01)

Diagram:



Examiner's Instructions

Provide trainee 5 minutes instruction and practice in paralleling and aligning parallel with a wall through use of LC signals. Review multiple signal use.

Guide trainee to starting position parallel to a wall 6' to his left.

SAY: "You are now parallel with the wall. I'd like you to walk forward, paralleling the wall. Don't make cane contact with the wall. Use the audible signals instead to keep informed on your position. Take your time. When the signals let you know that you're approaching a perpendicular wall, stop. Are the instructions clear? Please begin." (SCORE ITEMS E02 - E04)

After trainee detects perpendicular wall (via LC signals or cane contact) and stops, SAY: "Now I'd like you to turn so that you are parallel to that wall in front of you, and to walk parallel to it. Try to do this without making cane contact with the wall. Are the instructions clear? Please begin." (SCORE ITEMS E05 - E06)

Criteria	Test	ReTest
E02 Trainee avoids cane contact with wall	yes	yes
E03 Trainee maintains parallel line of travel over at least 75% of route	yes	yes
E04 Trainee stops before making cane contact with perpendicular wall	no	yes
E05 Trainee establishes a line of travel parallel to wall	yes	yes
E06 Trainee avoids cane contact with wall	no	yes

Notes/Remarks: (E07)

Trainee was rolling wrist, getting too close to parallel wall also - both causing incorrect signal to fire inappropriately.

Describes the situation and intent.

Lists items needed.

Specifies test dates and help required.

Describes the physical layout.

Describes what happened in the trial.

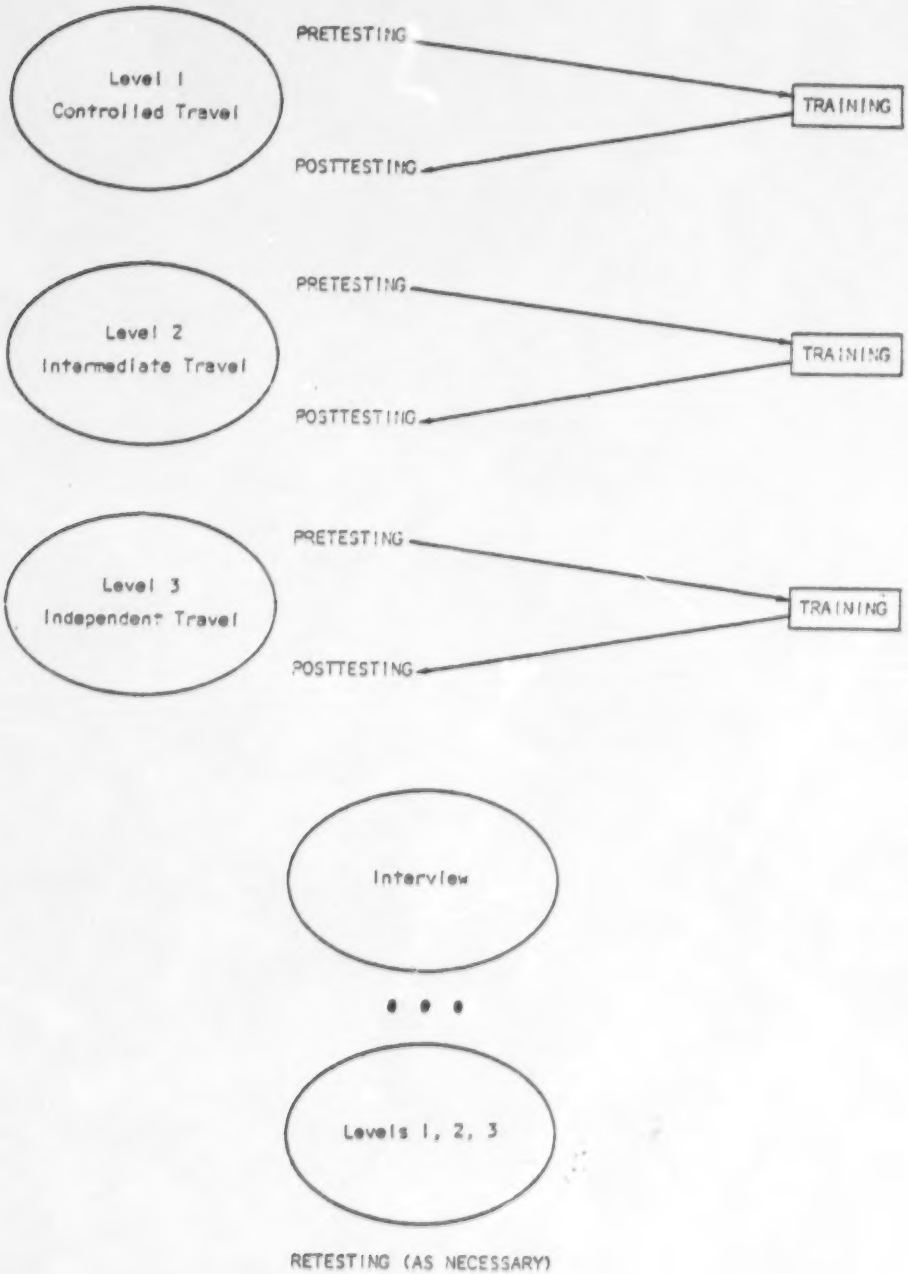
Describes special considerations or occurrences.

Gives precise directions.

APPENDIX C

Example of Revised Recommended Format for the Assessment of Trainee Performance Before and After Training

Performance Evaluation Strategy



Example

Lists instructional outcomes emphasized.

- ABILITY TO USE PUBLIC TRANSPORTATION
- ABILITY TO TRAVEL WITH INCREASED EFFICIENCY AND SAFETY
- ABILITY TO TRAVEL WITH A MINIMUM OF DEVIANT PERIPATETIC BEHAVIOR

EXERCISE 4
LEVEL 2

Describes the situation and intent.

Setting:

Outdoor. An unfamiliar route of about 1 block in a quiet residential area. There must be a mailbox (large, not pole-mounted) in the outside shoreline. There must also be some poles/trees in outside shoreline, but none should exceed one-half the width of the mailbox. The last object in the outside shoreline will be a bus-stop pole (any pole similar to a bus-stop pole will do).

Conditions:

Trainee will locate both a mailbox and a bus-stop pole on the basis of minimal verbal orientation to their locations. The mailbox will be in the outside shoreline about ½ block from his starting point. The bus-stop pole will be the last object in the outside shoreline. Trainee will attempt to detect and locate mailbox prior to making cane contact with it. The trainee will then continue along, trying to locate the bus-stop pole prior to making physical contact with it. He will then attempt to walk up to the pole and grasp it.

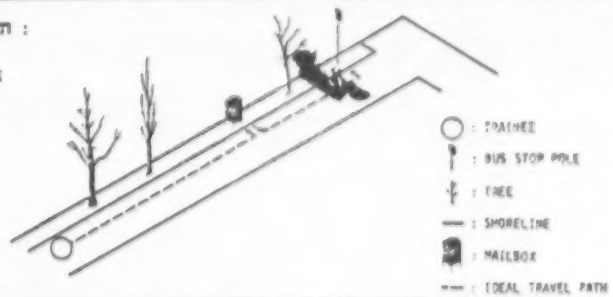
Purpose:

1) Test trainee's ability to detect and locate a specific laterally placed object in an unfamiliar area after receiving minimal verbal orientation to object's location.
2) Test trainee's ability to detect and locate such an object prior to cane contact or body contact with it.
3) Test trainee's ability to maintain a straight line of travel while seeking such an object.
4) Estimate time needed for trainee to locate several such objects (within a 1-block area).

Illustrated sequence of actions. "Variation" indicates one possible arrangement.

Diagram :

VARIATION



Place where exercise is conducted.

Test Location: corner 3rd + Elm

Example

Lists items needed.

DATA RECORDING

(L2)

Test date record and aid used.

Pre-Test (D01)	Post-Test (D02)	Re-Test (D03)
Date 9/20/78	Date 11/07/78	Date 11/07/78
Specify aid used Long cane	Specify aid used Laser Cane	Specify aid used Laser Cane

Explanations.

Notes/Remarks: Continued habit of trailing. Decided to retest for D05.

(D04)

Equipment Needs	
	1

Gives standard directions to be followed.

Examiner's Instructions:

Guide trainee to starting position. SAY: "I'd like you to walk along this block. In the outside shoreline there are a few slim poles/trees. There is also a mailbox and a bus-stop pole. I'd like you to find those two things. First find the mailbox, then go up to it and put your hand on it. You may use any technique you wish except soliciting aid. If you think you detect the mailbox before making cane contact with it, please stop and tell me. Tell me where you think it is before going on to make cane contact with it. The last object in the outside shoreline is the bus-stop pole. After you've found the mailbox, please continue along the block and find the bus-stop pole. Remember that there are a few other poles/trees in the outside shoreline. Are the instructions clear? Please begin."

(SCORE ITEMS D05 - D11 AS TRAINEE EXECUTES EXERCISE. SCORE ITEM D12 AFTER TRAINEE COMPLETES EXERCISE.)

Criteria	Pre	Post	Re
D05 Trainee detects mailbox without trailing with cane.	no	no	yes
D06 Trainee indicates detection & location of mailbox before making cane contact.	no	yes	
D07 Trainee maintains an essentially straight line of travel while seeking the mailbox.	yes	yes	
D08 TOTAL TIME ELAPSED SINCE TRAINEE BEGAN SEEKING MAILBOX	1'30"	45"	
D09 Trainee does not mistake another object for the bus-stop pole.	no	yes	
D10 Trainee locates bus-stop pole and makes body contact with it.	no	yes	
D11 Trainee maintains essentially straight line of travel while seeking pole.	yes	yes	
D12 TOTAL TIME ELAPSED SINCE TRAINEE BEGAN SEEKING BUS-STOP POLE.	30"	15"	

Describes what happened in exercise.

APPENDIX D

Newspaper Clippings Describing
Local Fund Raising Efforts
by a Training Center

The Times and Democrat

———— , S.C., 29115, Sunday, February 26, 1978, Page 1B

Blind Youth Gets Glimpse Of Freedom

By JOYCE W. MILKIE
Of The Times and Democrat

For the young, every day is a challenge, the beginning of something wonderful. But for the young - and blind - life can be a dark, lonely tunnel. Eager to taste all the good things of life, the excitement and learning experiences around them, but having to depend on others for any mobility at all, can be frustrating. The intelligent and ambitious person will grasp eagerly for anything offering a more independent existence.

One young man, ———— of ——, has had a glimpse of that independence, a half-hope that he can begin to function without the necessity of people helping him all the time. But it is only a glimpse; his laser cane will be taken away from him when his 30 hours of instruction in its use is ended.

Unless he can find $1,950 to buy a cane of his own, the little period of comparative freedom when he walked with sure feet on almost any street, will be ended. And —— isn't the only one; other blind South Carolinians also face this problem.

What is a laser cane?

Before going into that, let's meet ————. —— is 20 and has been blind since he was six years old. He remembers a little about the world around him before the accident which took his sight, but only a little.

For awhile, ——— attended ———— but when he reached the sixth grade, he came back to public school. He is a junior at ——— High, a good student, and hopes he can get all the credits he needs this year in order to enter college next fall.

ON HIS OWN — Walking with ease, moving along swiftly, ———— shows he has learned his lessons well. The long laser cane, which shoots a beam of light to locate objects in the path of a blind person, is a costly instrument. This one will be taken from —— once he has learned to use it. His instructors are concerned that funds be found to purchase one for him, and for others who may need devices of this kind but can't afford them. (T&D Photo by Joyce Milkie)

D-1

A slender blond youth, with shoulder length hair and a wispy mustache, ——— has a quiet, retiring manner. He says he wants to go to the University of South Carolina, or maybe Baptist College, but wherever he goes, he is considering majoring in religion, or possibly something in the electronics field.

When he goes away to school, there won't be relatives and friends to help him do the routine things in life, the things he must do every day. He will need to be able to get around easily and confidently and the laser cane seems to be the answer to his need.

Ed Robinson, orientation-mobility instructor for the S. C. Commission for the Blind and Laura Ray, itinerant teacher for visually handicapped students in seven school districts in ——— County, are enthusiastic about ———'s progress.

"I have worked with ——— since the seventh grade," Robinson said. "He is special; he has great potential and ability with this device. I want to see him progress and to do that, he needs the laser cane."

——— is fortunate to be one of only five people in south Carolina being trained under the electronics travel aids study of the American Institute for Research. And South Carolina is one of three centers in the United States being used by the project.

Under this program, four different electronic devices are being tested and instructors are determining which is most acceptable, then training people on the device best suited to them.

"These four devices are each excellent," Robinson said, "but no device is perfect for everybody. Some people just can't learn to use a laser cane, for example. With three of the devices, the individual must also use a traditional type 'long cane.' With the laser cane, it is all in one."

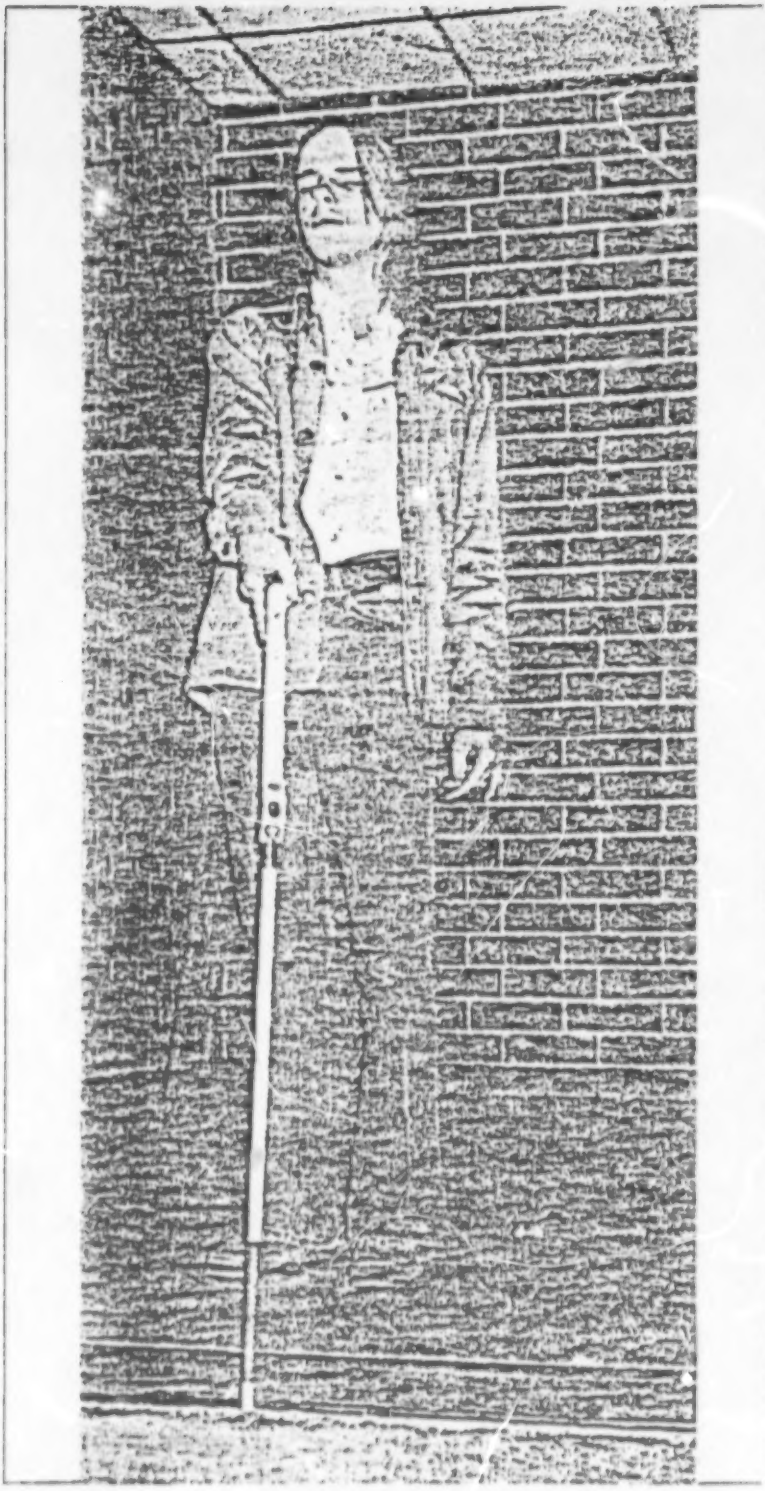
Robinson said the four devices are the Russell Path Sounder, a chest-held device; the Nottingham Nod, a hand-held instrument like a flashlight; the Sonic Guide, in the form of eyeglasses; and the Laser Cane.

———'s choice, what he was found best suited for, turned out to be the laser cane. He has been using it since Christmas.

The cane weighs about one pound, looks much like the usual "white" cane of the blind with some variations. It has a six-volt battery in the crook of the cane which is good for seven continous hours of use and can be recharged. It throws a beam of light which bounces off objects to warn not only of something in the path but also of low hanging objects or a drop off, such as a staircase.

The instrument was developed by Malvern Benjamin of Bionic Instruments, Inc. with a grant from the Veteran's Administration. The model ——— is using is the C-5, the latest model developed. Only two others in the state are using the cane. Of the five training on devices, three use the cane, one the Sonic Guide and the other is still undecided. Miss Ray noted anyone using the laser cane must have good auditory skills, a good sense of direction and of balance. ——— has these, she said.

DETERMINED — With set mouth and determined air, ——— ——— sets off with his laser cane to walk the streets of North by himself. Watching in the background is Miss Laura Ray, itinerant teacher for visually handicapped students in ——— County, and Ed Robinson, orientation-mobility instructor for the S.C. Commission for the Blind. Robinson is the only qualified instructor in the state for laser cane use. (T&D Photo by Joyce Milkie)



DROP OFF HERE! — The warning deep tone from the laser cane, held by ————, warns him he is approaching a staircase at —— High School.

"He can walk a straight line. He also has the intelligence to learn and sort out signals quickly," Miss Ray said.

—— described the types of signals. "There are three sounds," he said. "One is a single sound, like a beep, for anything in front of the cane. Then there is a multiple sound which warns of hanging objects and there is a deep buzzing sound which warns of a drop off ahead."

There is also a tactile control which gives a vibration against the hand, warning of dangers ahead.

Robinson is the only person in the state trained to instruct in the use of the laser cane; it keeps him busy getting around to all his students, he said.

He pointed out that only a "tiny segment" of the blind population can use any of these four devices.

And nothing, he added, will replace their sight. These are only additional aids to give them a life less dependent on others and to help them gain greater social contact.

But the problem facing most of those training on the devices is how to pay for their own device. Some, employed or with private means, buy their own. —— and a number of others aren't in this fortunate position. Miss Ray said it is her job to find the funds to purchase a cane for ——, but she admits it is hard going.

"It is unbelievable to me that he is going to learn this device, use it and realize the freedom it gives him, and then not be able to obtain a cane of his own," Miss Ray said, troubled.

She and Robinson are dedicated to the proposition that young —— is going to have his chance. They have a strong drive to solve this problem and to find resources to tap to help the young man. Both dedicated and idealistic people, as they must be to do this kind of work, they are yet realistic enough to realize that, in the real world, money makes life smoother.

Ray and Robinson want some of that soothing stuff so the life of at least this one client can be a more enjoyable experience.

The Times and Democrat

———, S.C., 29115, Sunday, June 25, 1978, Page 1B

Blind Youth's Friends Help Him Get $2,000 Cane

Special Gift

A special gift, a laser cane to make life easier, was presented to ——— Wednesday morning in North. From left: Ed Robinson, orientation mobility specialist; Bobby Jackson, president, ——— Lions Club; ———; Sonja Gleaton, chairman, fund raising drive; Eston Waldrop, treasurer, ——— Lions Club. The Lions worked closely with Mrs. Gleaton in a fund raising drive to earn the nearly $2,000 necessary to buy the cane, a newly developed aid for the blind.

By JOYCE W. MILKIE
Of The Times and Democrat

——— Tries It Out

——— tries out his new laser cane, purchased with funds raised from individuals to the tune of $1,950. ———, one of the few people trained on the cane, said this will give him much more mobility and independence. Shown with him are the Rev. A. O. Davis and Ed Robinson, orientation mobility specialist, S.C. Commission for the Blind.

———, S.C. – ——— is blind, but he has a lot of friends, and those friends raised more than $2,000 to make a dream come true for him.

——— had an opportunity only a few blind youngsters have; he was offered the chance to learn to use a laser cane, a new invention to make life easier, more independent, for those of limited, or no, vision.

He trained and he learned well. One of the best students they had, said his instructor and the South Carolina orientation mobility specialist who supervised his progress. But South Carolina said once he was trained, the cane would be taken away from him; there was no money to give him one, he'd have to buy his own.

But ——— had no money, either. His parents wanted desperately to buy him one, but they couldn't afford it.

The Times and Democrat printed a story about him, and then things began to happen.

"After reading the article in The Times and Democrat about ——— and the Laser Cane he needed, I felt the urge to respond," said Sonja Gleaton of ———.

"I discussed it with our pastor, the Rev. A. O. Davis, and suggested the possibility of having a benefit to raise money. We got ———'s approval and set to work. Mayor Nick Chaplin of ——— offered the use of the ——— Recreation Center for March 11.

"I appealed to the local ladies church organizations and they sponsored a successful bake sale. Church singing groups entertained with radio personality Bob Magee doing the honors as emcee. He worked very hard on this project and he even sang our closing song.

"Wayne Templeton, Fireman Ross Gleaton, Gary Bonnette and Eddie Davis all contributed time, work, and special fund raisers. Merchants from ———, ——— and ——— supplied items for concession stands and auction. Auctioneer George Kirby volunteered his services. Marty Williams and his puppet show was a crowd pleaser and 'Mr. Puppet' sang 'You Light Up My Life' especially for ———.

"People from all churches, all denominations were on hand. Pastors came and stayed all day and even helped afterward.

"Lions Club member Eston Waldrop is responsible for getting the Lions to sponsor the benefit and for setting up the trust fund for ———.

"March 11, in the tiny town of ———, we raised $913.58 for a very special youth, ——— ———. That was the beginning and it was BEAUTIFUL'" Mrs. Gleaton said.

The Lions Club announced a total of $2,310.97 was raised. The cane cost $1,950. Last Tuesday, Waldrop and some of ———'s other friends made the formal presentation. ——— has his cane.

At the presentation, they said they hoped others will be inspired to help other youngsters like ———, to give them the chance at a fuller and richer life.

The Times and Democrat is happy it too could play a part in making a young man's dream come true.